

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE
AND PLANT DISEASES

IR V. - NUMBER 12

DECEMBER 1914



* ROME: PRINTING OFFICE OF THE INSTITUTE. 1914 * * * *

In quoting articles, please mention this BULLETIN.

CONTENTS

FIRST PART: ORIGINAL ARTICLES.

ALF, FEDERICO. The Forests of Chile	Page 1535
FER, ISTVÁN. The Development of the Dairy Industry in Hungary	1542
SON, JAKOB. The Control of Plant Diseases in Sweden.	1546

SECOND PART: ABSTRACTS.

AGRICULTURAL INTELLIGENCE.

I. — GENERAL INFORMATION.

IZATION OF EXPERIMENTAL AND ANALYTICAL WORK. — 1086. Report of the Work of
12 Experiment Stations and Experiment Fields of Annam, 1913.

II. — CROPS AND CULTIVATION.

a) GENERAL

CULTURAL METEOROLOGY. — 1087. The Climate of Ethiopia.
PHYSICS, CHEMISTRY AND MICROBIOLOGY. — 1088. Estimation of Phosphates in Soil
tracts. — 1089. *Azotobacter* in Connection with Nitrification.
NMENT IMPROVEMENTS. DRAINAGE AND IRRIGATION. — 1090. Overhead Watering
lant. — 1091. Irrigation Scheme for Sind: Development of Cotton.
SE AND METHODS OF CULTIVATION. — 1092. Experiments in Tilling the Soil by Means
Explosives.
RES AND MANURING. — 1093. Relative Effect of Lime as Oxide and Carbonate on Certain
ols. — 1094. Duration of the Action of Manures. — 1095. Prohibition of the Collection
Guano in the Ballestas Islands, Peru. — 1096. Recent Inoculation Experiments on
irgin Sphagnum-Moor Soils, with Various Cultures of Bacteria of Leguminosae. —
97. Consumption of Fertilizers in South China.

b) SPECIAL

CULTURAL BOTANY, CHEMISTRY AND PHYSIOLOGY OF PLANTS. — 1098. Fractional
alysis of Wheat. — 1099. Studies on the Mulberry Leaf. — 1100. Methods of Estimating
arbohydrates: II. The Estimation of Starch in Plant Material. — 1101. Estimation of
ydrocyanic Acid in Feeding-Stuffs and its Occurrence in Guinea Corn. — 1102. Some
ccessory Factors in Plant Growth and Nutrition.

- PLANT BREEDING. — 1103. Lax- and Dense-Eard Wheats. — 1104. On the Emasculation of Giant Maize in Serbia. — 1105. Alfalfa Hybridization.
- AGRICULTURAL SEEDS. — 1106. The Controlling Influence of Carbon Dioxide in the Maturation, Dormancy and Germination of Seeds. — 1107. Tree Growth and Seed.
- CEREAL AND PULSE CROPS. — 1108. Studies upon Influences affecting the Protein Content of Wheat. — 1109. Variation of Gluten in Wheat Flour and Grain. — 1110. Experiments with Autumn-sown Crops in Ontario, in 1911. — 1111. On the Botanical Origin of Cultivated Rice.
- FORAGE CROPS. MEADOWS AND PASTURES. — 1112. Accumulated Fertility of Grassland Consequence of Phosphatic Manuring.
- FIBRE CROPS. — 1113. Cotton in South Africa. — 1114. *Urena lobata* in the Wild State in Madagascar. — 1115. *Agave Sisalana* and *Fourcroya gigantea* in Cape Verde.
- CROPS YIELDING OILS, DYES AND TANNINS. — 1116. Seeds of *Trichilia* from the Nigerian Sudan.
- RUBBER, GUM AND RESIN PLANTS. — 1117. Recent Data on Rubber Plantations. — 1118. Rubber: Tapping and Tapping Systems.
- SUGAR CROPS. — 1119. The Use of Sweet Sorghum as a Source of Commercial Sugar or Fodder.
- STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS. — 1120. Tea: Manuring at Peradeniya. — 1121. Irises used in Scent-making. — 1122. Effect of Shading on the Transpiration and Assimilation of the Tobacco Plant in Cuba. — 1123. Medicinal Plants in South Africa.
- MARKET GARDENING. — 1124. Market Gardening in Spain.
- FRUIT GROWING. — 1125. A Kaki Classification. — 1126. The Siamcese Seedless Pomelo. — 1127. *Prosopis juliflora* and *P. pubescens*. — 1128. The Jaboticaba (*Myrciaria*). — 1129. Manuring Experiments with Coconuts at Peradeniya. — 1130. Manuring of Bananas.
- FORESTRY. — 1131. A New Oak for Breeders: *Quercus insignis*. — 1132. West Indian Boxwood. — 1133. Experiments on the Grazing of Woodlands.

III. — LIVE STOCK AND BREEDING.

a) GENERAL.

- HYGIENE. — 1134. The Hygienic Significance of Acid-Rennet Bacteria in the Udders of Cattle. — 1135. Poisoning by *Sorghum halepense*. — 1136. Modifications produced in the Antigenic Properties of Bacterium by Ultra-Violet Rays. — 1137. Pyroplasmiasis in Cattle in Hungary and its Means of Control. — 1138. Preventive Inoculation against Sheep and Swine Plague. — 1139. Studies on Fowl Cholera: the Inheritance in Rabbits of Immunity to Infection by the Bacterium of Fowl Cholera.
- ANATOMY AND PHYSIOLOGY: GENERALITIES. — 1140. On Ovariectomy in Sows, with Observations on the Mammary Glands and the Internal Genital Organs. — 1141. On Factors Controlling Fertility in Domestic Animals. — 1142. Research on the Transformation of Energy in the Domestic Fowl.
- FEEDS AND FEEDING. — 1143. The Preparation of Ensilage. — 1144. The Feeding Value of *Polygonum lapathifolium*. — 1145. Influence of Temperature on the Microflora of Lactic and Butyric Ferments. — 1146. The Food Value of *Stizolobium aterrimum* and *S. lobatum* Beans. — 1147. Statistics of British Feeding Trials and the Starch Equivalence Theory. — 1148. Feeding Experiments with Whole Milk and Skimmed Milk with Substitutes.

b) SPECIAL.

- HORSES, ASSES AND MULES. — 1149. The Breeds of Horses of the Sunda Archipelago.
- CATTLE. — 1150. Holstein Milk Yield. — 1151. Economical Cattle Feeding in the Congo.
- SHEEP. — 1152. Origin of Karakul Sheep.

CONTENTS

v

- 5 — 1153. Pasture and Grain Crops for Hogs in the Pacific Northwest. — 1154. Pig Feeding Experiments in Germany.
 8 — 1155. Apiculture in Uganda.
 REFORMS. — 1156. The Silk Weaving Industry of Amarapura, Burma. — 1157. Researches in Sericulture in Cambodia.

IV. — FARM ENGINEERING.

- AGRICULTURAL MACHINERY AND IMPLEMENTS. — 1158. Motor Tillage Machine with Oscillating Spades turning sideways. — 1159. Rapid Drying and Preservation of Wood by Nodon's Electrical Process. — 1160. A Latex Hydrometer. — 1161. New Water-raising Device. — 1162. Review of Patents.
 DRAINAGE CONSTRUCTION. — 1163. Bold Concrete Dam.

V. — RURAL ECONOMICS.

1. On the Selection of Crop Rotations. — 1165. Statistical Data on the Economy of the Farms belonging to the Cooperative Book-keeping Association of Königsberg in Prussia. — 1166. Comparative Cost of Food for a Heifer, Stall-fed or at Grass, up to her First Calving. — 1167. A Metayers' Family in Chianti, Tuscany.

VI. — AGRICULTURAL INDUSTRIES.

- INDUSTRIES DEPENDING ON PLANT PRODUCTS. — 1168. The Origin, Quantity and Signification of Lactic Acid in certain Italian Wines. — 1169. Spanish Wines. — 1170. The Wines of Istria. — 1171. Influence of Nitrogen Compounds on the Vulcanization of Rubber.

- INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — 1172. The Cause of Acidity in Fresh Cow's Milk, and a Method for the Determination of Acidity. — 1173. Ability of Streptococci to Survive Pasteurization. — 1174. Action of Bacteria on the Ripening and Flavour of Cheese of the Cheddar Type. — 1175. The Part Played by Micro-Organisms in the Ripening and in the Production of the Pungent Flavour of Brindza Cheese. — 1176. The Phosphorus Content of Casein. — 1177. A Comparison between the Fat Stock and the Carcasses exhibited at the Smithfield Show, 1913. — 1178. Quality in Wool. — 1179. Libyan Hides and Skins.

- AGRICULTURAL PRODUCTS: PRESERVING, PACKING, TRANSPORT, TRADE. — 1180. Experiments on Storing Swedes during the Winter, in Denmark.

PLANT DISEASES.

II. — DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

- Further Notes on a Disease of Red Clover in Tuscany. — 1182. Blossom-end Rot of Tomatoes.

III. — BACTERIAL AND FUNGOID DISEASES.

- REALITIES. — 1183. Contributions to the Cryptogamic Flora of Thuringia. — 1184. Contribution to the Mycological Flora of Serbia. — 1185. *Pellicularia Koleroga* injurious to Coffee in Porto Rico.

- RESEARCHES. — 1186. Contribution to the Morphology and Life-History of *Pestalotia juncea* Desm.

- BACTERIAL AND FUNGOID DISEASES OF VARIOUS CROPS. — 1187. *Puccinia Menthae* on *Mentha canadensis* var. *piperascens* in Hungary. — 1188. American Gooseberry Mildew in Italy. — 1189. *Hypochnus Burnati*, a New Fungus on the Vine in Switzerland.

1190. Parasitic Flowering Plants on Para Rubber Trees in Negri Sembilan, F. M. S. — 1191. Experiments on the Food Requirements and Growth of Couch (*Agropyron repens*).

V. — INSECT PESTS.

GENERALITIES. — 1192. New Coccidae in Japan.

MEANS OF PREVENTION AND CONTROL. — 1193. New Species of Hymenopterous Parasites *Heliothis armigera* and *Caradrina exigua* in Russian Turkestan.

INSECTS INJURIOUS TO VARIOUS CROPS. — 1194. *Dichomeris ianthes*, *Catopsilla crocealis* & *Cataglyphis pandava*, injurious to Lucerne, Cassias and Cycas in Ceylon. — 1195. *Aspidiotus* Pests of Camphor in Ceylon. — 1196. Outbreak of *Malacosoma fragilis* in California. 1197. *Philocotribus scarabacoides* and *Hylesinus oleiperda*, Beetles injurious to Olives in the Arezzo District, Italy. — 1198. *Tetropium gabrieli* var. *crawshayi* on Larch in England.

The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART.
ORIGINAL ARTICLES

The Forests of Chile.

by

FEDERICO ALBERT,

Inspector General of Forests, Hunting and Fisheries, Santiago.

Of the 185 939 400 acres which constitute the whole area of Chile, 67 750 acres are covered with forest. The distribution of the forests is very irregular and is made clearer by dividing them into the following forest regions :

Region I. — From the northern frontier of the Republic as far as Taltal, including the provinces Tacna, Tarapaca and Antofagasta, of which only from 0.01 to 0.03 per cent of the area (in all 52 000 acres) is wooded. The forests are composed of *Prosopis Tamarugo*, *Cordia alliodora* and other less important species.

Region II. — From Taltal to the river Choapa ; this includes the provinces Atacama and Coquimbo, of which only from 0.3 to 2.5 per cent (in all 226 600 acres) consists of forests. The trees here are *Gourliea decumbens*, *Caesalpinia brevifolia*, *Porlieria hygrometrica*, etc.

Region III. — From the river Choapa and to the south as far as Maule. This district includes the provinces Aconcagua, Valparaíso, Santiago, O'Higgins, Colchagua, Curico and Taltal, with a total of 1 732 000 acres of forest ; in the first four the forest area does not exceed 5 to 8.5 per cent, while in the last three it may amount to 12 or even 17 per cent. The forests of the first group of provinces contain only *Acacia Cavenia*, *Bellota chilensis*, *Quillaja saponaria*, *Maytenus Boaria*, *Litsea caustica*, *Boldoa patagonica*, *Cryptocarpa Peumus*, *Drimys Winteri*, *Prosopis Siliquastrum* and other secondary species, while in those of the three last we already find *Notofagus macrocarpa*, *N. obliqua* and *N. Dombeyi*, *Gevuina chilensis*, *Kazeneckia oblonga* and *Libocedrus chilensis*, with other less important species.

Region IV. — From the river Maule to the river Valdivia, including the provinces Linares, Maule, Ñuble, Concepcion, Arauco, Bio-Bio, Malleco, Cautin and a large portion of Valdivia, with a total of 5 700 acres of forest; the percentage reaches from 17.5 to 35.5. The abundance of forests increases in the following order: Valdivia, Bio-Bio, Malleco, Ñuble. As far as the river Bio-Bio, the exploitable timber is furnished by the following species: *Acacia Cavenia*, *Quillaja saponaria*, *Maytenus Boaria*, *Litrea caustica*, *Boldoa fragrans*, *Cryptocarpa Peumus*, *Drimys Winteri*, *Nothofagus obliqua*, *N. Dombeyi*, *Gevuina Avellana*, *Persea Lingue*; to the south of Bio-Bio, *Acacia Cavenia* and *Quillaja saponaria* are absent while in addition are found: *Lomatia dentata*, *Myrceugenia apiculata*, *Podocarpus andina*, *Prumnopitys elegans*, *Araucaria imbricata*, *Nothofagus procera*, *Laurelia aromatica*, *Myrceugenia Luma*, *Nothofagus Pumilio*, *Libocedrus tetragona*, *Myrceugenia Temu*, *Myrceugenia multiflora*, and other less important species.

Region V. — This extends from the river Valdivia to the peninsulas Taitao, including the provinces Valdivia (southern part), Chiloé and Llanquihue, with a total of 11 145 000 acres of forest (40 per cent of the whole area of the region). This region is already outside the range of *Araucaria imbricata*, *Nothofagus procera* and *Laurelia aromatica*, while *Nothofagus obliqua*, *Maytenus Boaria*, *Libocedrus chilensis*, *Nothofagus Dombeyi*, *Persea Lingue* and *Podocarpus andina* are not found beyond the Chacao canal; on the other hand the following begin: *Embothrium coccineum*, *Clusia paniculata*, *Weinmannia trichosperma*, *Sophora tetralera*, *Myrceugenia Meli*, *M. planipes*, *Tepualia stipularis*, *Maytenus magellanica*, *Nothofagus nitida*, *N. betuloides*, *Libocedrus tetragona*, *Fitzroya patagonica*, *Laurelia serrata*, *Eucryphia cordifolia*, *Podocarpus chilina*, *Lomatia ferruginea* and other species in small numbers.

Region VI. — This comprises all the territory of Magellan as far as Tierra del Fuego, and has some 20 million acres of forest, or about 30 per cent of its area. These forests consist of the trees mentioned as occurring south of the Chacao canal, with the exception of *Nothofagus nitida* and *Lomatia dentata*, but gradually the number of all the trees decreases till there remain only *Nothofagus betuloides* and *Maytenus magellanica* and some species of *Myrceugenia* as stunted shrubs.

From the area of 38 million acres classed as forest, must be deducted 8 908 200 acres used as pasture, 18 576 950 acres which produce firewood only, and 6 092 180 acres which only supply stakes and small wood; therefore remain only 5 002 110 acres which can be exploited for timber.

A very important fact which merits consideration also is that of the 38 million acres covered with forest, 20 million acres are upon agricultural land, about 7 ½ million acres are under forest that is beginning to grow or are pasture, or of uncertain classification and only 11 400 000 acres are on true forest land. On the other hand, nearly 10 million acres of forest land which were formerly wooded are now completely cleared, the greater part being eroded and worn into gullies by rain, so that it

come under the category of waste land. The immoderate deforestation practised for the purpose of obtaining fuel, and the irrational system of cultivating steep slopes liable to slip under the influence of heavy rains, maintain the present existence of 153 000 acres of dunes and the want of water for irrigation, drinking purposes, etc., which prevails in the spring and autumn.

The exploitation of the existing forests requires means of transport, alteration of river courses, construction of roads and a thorough system of railways. Only concerns with abundance of capital (which is lacking in our country) could undertake such operations, all the more as the State does not possess the necessary funds to carry out the work at its own expense. Wealthy foreign capitalists are therefore required in Chile, where they will find an extensive and lucrative field for the development of their trade.

Generally wood in Chile is sold green as soon as it has been felled; it is badly worked, or hastily piled up, so that it arrives on the market warped, cracked and out of shape.

There are only a few firms which have drying apparatus and it is necessary to encourage and increase such plant, in order that the wood may be dried in the best condition possible. The consumption of the country is not sufficient to absorb the enormous amount which should be produced from the forests in the next few years. The export of wood should be based on transport by sailing ships, which is more economical than transport by steamers, all the more, seeing that at present there are no means of lowering steam freights, which are very high, amounting to from 30 to 40 shillings per cubic metre (35 cu. ft.) from Chile to Europe.

The two first forest regions were exclusively engaged in importing, but they are now beginning to export pods of *Prosopis Siliquastrum*, which contain from 35 to 50 per cent. of tannin; they give a tawny yellow colour to leather and render it supple. *Cordia decandra*, already rather a rare tree, is a yellowish brown wood with pretty black markings and is used for ornamental veneering. The wood of *Porlieria hygrometrica* can be used for engraving.

The third forest region also has to import wood; it furnishes the bark of *Quillaja saponaria*, which contains from 15 to 25 per cent. of saponin and is largely exported. For furniture making are used the wood of *Bellota chilensis*, *Maytenus Boaria* and *Drymis Winteri*, while the wood of *Prosopis Siliquastrum* is used by the cabinet-maker and enlayer; it resembles that of *Cordia decandra*, but is already very rare. *Acacia Cavenia* might be used for ornamental purposes, but is generally burnt for charcoal or as firewood or by the wheelwright; the same applies to the wood of *Quillaja saponaria* and *Prosopis Siliquastrum*. The leaves of *Boldoa fragrans*, its extract, the well-known *boldoina*, a remedy for diseases of the liver, stomach and digestive systems and also for internal parasites, should be important articles of export. The present stock of *Nothofagus obliqua*, *Macrocarpa* and *Libocedrus* no longer suffices for the most pressing needs of the district.

The fourth forest region, in its part to the north of the river Bio-I only exports *Quillaja saponaria* bark, for it does not produce sufficient wood for cabinet-making even to supply its own requirements, and is obliged to obtain it from the provinces south of this river. These, which are usually called "La Frontera", possess the richest forests of the Republic.

In the first place we may mention as growing there: *Nothofagus obliqua* yielding a dark red wood, hard and heavy, which lasts for 25 years and more in the ground, and is more resistant than that of most pines and is much used for beams, planks, wharves and piles.

Nothofagus Dombeyi, when its heartwood is of a dark red color shot with pale reddish or greenish hues, is as durable as *N. obliqua* and a little harder; in the trade the two timbers are confused. The pink *Nothofagus Dombeyi* does not last long, while the white form, which covers large tracts of country, could, owing to its low price, be used advantageously in the chemical manufacture of cellulose, but its lack of durability renders it of doubtful value in the mechanical process where cylinders are used.

The wood of *Nothofagus procera*, which is dark red with a slight violet reflection, is a little less hard than that of *N. obliqua*; it is durable, easy to work and polish, does not break and is the material most used in the interiors of houses. On account of its good qualities, it is difficult to find a substitute. Doors, furniture and windows of this wood last indefinitely; it is also much used for small casks for ordinary wines and in cooperage generally. It is perhaps the best wood for the above-mentioned purposes.

The wood of *Laurelia aromatica* is of an ashy yellow colour, sometimes with dark spots or lines; it warps and is not very durable in damp, but is much used, and with good results, for the interiors of houses and for furniture.

Persea lingue wood is reddish, pinkish, or yellowish, sometimes with pretty dark rays. It is heavy, hard, elastic and fibrous and adapted for all purposes. As it retains dyes well, this product is used in the imitation of "nogal", "caoba", etc., and is with good reason much appreciated in the country.

The wood of *Podocarpus andina* is of a lemon-yellow colour, less hard and more supple than the preceding products, and is used in the interiors of houses both by the joiner and the carpenter. It is not very plentiful.

Libocedrus wood is yellowish white with pale brown rays, a little reddish in the centre; it is supple, elastic, fibrous, perfumed, does not decay and is used for all kinds of building, furniture, carpentry, beams, posts, props, etc. It is much appreciated in the country, but difficult to export because it grows on slopes far from all means of transport.

Myrcogenia Luma yields a dark red, heavy, very hard, elastic wood which does not decay and is most suitable for wheelwright's and carpenter's work, especially in the making of poles, wheel spokes, stakes, etc.

The wood of *Araucaria imbricata* is whitish, a little yellowish, supple, hard and durable; it is employed for all kinds of structures, furniture, posts, and even beams, but as the tree grows on the summits of distant

tain it has only lately begun to be exploited. The seeds of this serve as an article of food for the peasantry during much of the year. The following would be very valuable woods for furniture, veneers, etc., both in Chile and abroad: *Gevuina Avellana*, *Lomatia dentata*, *Prumnopitys elegans* and *Drimys Winteri*; but, on account of the fashioning foreign products, these will not be appreciated at home as they are until the appreciation of the exported timber shows that we have rightly valued our national riches.

The barks of *Persea Lingue* and of *Drimys Winteri* are decidedly resistant, and might be even more so; these are richest in tannin (15 to 20 per cent) when they are thinnest, and are stripped from the trees at the end of winter or in early spring. This bark is the best adapted for making leather for soles.

The fifth forest region, in spite of its abundant forests, imports some of *Nothofagus obliqua*, *N. procera* and *Persea Lingue* from the fourth region, as well as *Weinmannia trichosperma*, *Caldcluvia paniculata*, *Sorbus tetralix*, *Myrceugenia Meli*, *Tepualia stipularis*, *Eucryphia cordifolia* and *Laurelia*. The other species are not yet well enough studied and are of less industrial importance.

The wood of *Fitzroya patagonica* is light red or reddish brown; it is elastic and soft, but firm, fibrous and almost without knots; it does not decay, is easy to cut, and does not warp or split. It is used for all kinds of work: furniture-making, carpentry, cooperage, musical instruments, building-cases, and especially for building in the south, as well as for sheds, roofs and roofs; it is also exported abroad. This wood is much appreciated, but cannot be sufficiently exploited on account of the difficulties in transporting the giant trees from their habitat in the high mountains. *Libocedrus tetragona* and *Podocarpus andina* of the south replace by the quality of their wood the similar species which are found further north. *Nothofagus nitidus* and *N. betuloides* cannot in the same way replace *Nitidus* of La Frontera, with which they have nothing in common but the popular name, for their wood rots, splits, warps and spoils. In the same way, *Laurelia serrata* cannot replace the Frontera "laurel", for, in addition to other defects, it is less durable and has a strong smell.

The wood of *Eucryphia cordifolia* is dark reddish, hard, heavy, resistant, does not decay in water, but rots when in contact with the soil. It is used in houses for carpentry, joinery, cabinet-making; also, with varying results, for the piles of quays and for props, stakes, wheelwright's work, etc. The bark of this tree gives a hard leather and contains as much tannic acid as that of *Persea Lingue*, or more.

For flooring and high-class furniture the following woods can be used: *Lomatia ferruginea*, *Embothrium*, *Sophora*, *Tepualia*; as well as others which have been mentioned above, such as *Gevuina*, *Lomatia dentata*, *Prumnopitys*.

Good beams can be made from the wood of *Caldcluvia* and *Weinmannia* and posts from the latter as well as from *Sophora*, *Myrceugenia Meli*, *Tepualia*; while *Prumnopitys*, *Gevuina*, *Embothrium*, *Myrceugenia*

planipes, *M. multiflora* and *Maytenus* are used in carpentry, and *Myrceugenia Meli*, *Persea* and *Sophora* for carts and wheelwright's work; the "curam" more or less replaces *Nothofagus procera* for these purposes. Good charcoal can be obtained from *Myrceugenia Luma*, *Caldcluvia*, *W. mannia*, *Sophora*, *Myrceugenia Meli*, *Tepualia* and *Eucryphia*; the latter are used by preference for building timber.

All this would be very satisfactory, were it not that the least useful species are the most plentiful and grow largest, while the most useful the rarest and smallest, with the exception of *Myrceugenia Luma*. *M. Meli*: these are fairly plentiful and form from 6 to 9 per cent of forest trees, while the other species only amount to 0.5 or at most 2 cent of the whole.

The sixth forest region already imports much more timber of *Nothofagus obliqua*, *N. procera* and *Persea* than the fifth region, although it figures as possessing half the forests of the Republic; it also takes from the forest region small quantities of the wood of *Libocedrus*, *Fitzroya*, *W. mannia*, *Caldcluvia*, *Myrceugenia Meli*, *Tepualia* and other trees, though it possesses the same species; this is owing to the want of means of communication, and to the fact that the trees decrease in size and become irregular as they approach the south and gradually disappear.

There is a large field for exploitation and trade in the native timber which make up about 40 per cent of the forests in Magellan, but it must be borne in mind that lack of means of transport, the steepness of the slopes, the many new species unknown in the wood trade, and the present high freights necessitate that the exploitation of these natural riches should be undertaken by large firms.

The study of Chilean timbers shows that there are very few soft wood kinds like *Fitzroya* and *Libocedrus*, but that, on the contrary, hard wood species abound; further, there is no substitute for oak for making carriages or for fine wines. This accounts for the importation, in 1912, of 1½ million cubic feet of pine wood (chiefly Oregon pine, *Pinus taxifolia*) to the value of £ 160 000, of which 91 per cent came from the United States and only 9 per cent from Europe. The same thing occurs in the case of oak staves, of which 1500 tons, worth £ 8000, are imported, while the value of the exported wood is only £ 23 000. With good management and administration, the value of these exports might amount to nearly a million sterling, and be a source of considerable revenue to the country.

Attempts are being made to supply the want of soft wood in Chile by planting rows of poplars, but their wood will never adequately replace that of the native species for general use.

Plantations of pines on a large scale have only been made by the coal-mine proprietors, as at Lota and Curanilahue, while small plantations have been made by some of the more progressive landowners. The trees planted by the State on the dunes of Chanco are a mere drop in the bucket as far as the present needs of the country are concerned and afford no adequate provision for future requirements. Nearly all the plantations consist of poplars (usually *Populus nigra*), *Pinus insignis* or *Eucalyptus*.

us, as rapid production is preferred to quality, to the exclusion of yielding good wood such as: *Pinus canariensis* and *P. maritima*, *Cypripedium diversicolor* and *E. resinifera*, *Cupressus macrocarpa* and *C. to-*
Acacia melanoxylon, *Quercus pedunculata*, *Picea excelsa*, *Pinus*
rosa and *P. mitis*, *Abies*, *Picea*, *Larix*, etc. It would be well worth
to organise also in Chile syndicates, and national and foreign societies
provided with capital, which could turn their attention to the pre-
tion, good exploitation and re-planting of the forest land of the Re-
c, taking as a basis the best native species, and at the same time plant-
uch exotic trees as are acclimatised and grow even better in Chile
in their original habitat.

The want of foresight as regards the preservation, exploitation and
ation of forests is such, that any firm undertaking this work on a
is basis, can be assured of the future of its industry, all the more,
one in the country thinks of future needs, and scarcely even considers
at necessities.

List of the trees mentioned above with their local names.

<i>Cavenia</i> . . .	espino comun.	<i>Myrceugenia apiculata</i>	arrayan.
<i>aria imbricata</i> . . .	araucaria, piñon.	„ <i>Luma</i> . .	luma.
<i>Miersii</i> . . .	belloto.	„ <i>Meli</i> . .	meli.
<i>fragrans</i> . . .	boldo.	„ <i>multiflora</i>	pitra.
<i>Pinus brevifolia</i> . .	algarrobo.	„ <i>planipes</i> .	peta.
<i>Pinus paniculata</i> .	tiaca.	„ <i>Temu</i> . .	temu.
<i>decandra</i> . . .	carbon.	<i>Nothofagus betuloides</i> .	roble de Magellanes.
<i>Myrica Peumus</i> . .	peumo.	„ <i>Dombeyi</i> . .	coihue.
<i>Winteri</i> . . .	canelo.	„ <i>macrocarpa</i>	roble de Colchagua.
<i>Myrica coccineum</i> .	ciruelillo.	„ <i>nitida</i> . .	r. de Chiloe.
<i>Pinus cordifolia</i> . .	ulmo, muermo.	„ <i>obliqua</i> . .	roble pellin.
<i>Pinus patagonica</i> . .	alerce.	„ <i>procera</i> . .	raulí.
<i>Pinus Avellana</i> . . .	avellano.	„ <i>Pumilio</i> . .	nire.
<i>Pinus decorticans</i> . .	chañar.	<i>Persea Lingue</i>	lingue.
<i>Melia obliqua</i> . . .	bollen.	<i>Podocarpus andina</i> . .	mañiu.
<i>Pinus aromatica</i> . .	laurela.	„ <i>chilina</i> . .	mañiu.
<i>Pinus serrata</i> . . .	huahuan, laurela.	<i>Portiera hygrometrica</i> .	guayacan.
<i>Pinus chilensis</i> . .	cipres.	<i>Prosopis Siliquastrum</i> .	algarrobo.
<i>Pinus tetragona</i> . .	cipres de Guaitacas.	„ <i>Tamarugo</i> . .	tamarugo.
<i>Pinus caustica</i> . . .	litre.	<i>Prumnopsis elegans</i> . .	leugue.
<i>Pinus dentata</i> . . .	radal.	<i>Quillaja saponaria</i> . .	quillai.
<i>Pinus terruginea</i> . .	huinque.	<i>Sophora tetraptera</i> . .	petú.
<i>Pinus Boaria</i> . . .	maiten.	<i>Tepvalia stipularis</i> . .	tepú.
<i>Pinus magellanica</i> .	m. de Magellanes.	<i>Weimannia trichosperma</i>	teñiu.

The Development of the Dairy Industry in Hungary (1).

by

Dr. ISTVÁN KOERFER,

Chief of the Dairying Section of the Hungarian Ministry of Agriculture, Budapest

Of late years the Hungarian dairy industry has altered its aims. Formerly it dealt chiefly with the various methods of utilizing the milk was produced, whilst at present, without giving up its old principle, seeks to increase the yield of milk itself.

According to the last census, Hungary possessed 2 800 000, which yielded about 808 million gallons of milk; at a price of 5.91 gallon, this represents a value of £ 19 867 700. For this estimate we taken as basis the average yield of each of the breeds as shown in Table

TABLE I. — *Average yearly yield of the various breeds.*

Breeds	Head	Average yearly yield	
		Per cow, gals.	Total.
Hungarian	630 000	198	124 7
Red spotted:			
Simmental & Pinzgau	1 700 000	330	561 0
Gray Alpine	90 000	396	35 6
Other breeds	290 000	242	70 4
Buffaloes	90 000	176	15 8
Total	2 800 000	—	807 6

In 1913 the value of the exports was as follows :

	£
Milk	443 034
Butter	206 571
Cheese	88 390
Total	797 995

The milk and its products were exported to the following countries: Austria, Bosnia-Herzegovina, Germany, Switzerland, Italy, Netherlands, Rumania, Serbia, Bulgaria, Albania, Greece, Turkey in Europe and in Asia, Egypt, United Kingdom, Russia and United States.

(1) See No. 678, B. July 1914.

The total exportation of milk, butter, cheese and condensed milk corresponds to 36 029 532 gallons of milk. Comparing these figures with the 520 000 gallons of milk produced and mentioned above, it will be seen our exportation of milk represents 4.46 per cent of the total production. During the closing years of the nineteenth century there were still many communes in Hungary in which milk could not be disposed of at anything like profitable prices. This fact induced the Ministry of Agriculture to favour the institution of cooperative rural dairies. These were first rather collecting centres than real dairies, the cream being taken to the central dairies and the skimmed milk sent back to the members. Controlled by two joint stock companies, the central dairies are under the control of the State, which subventions them. They produce butter of the best quality, much appreciated at home and abroad. The first central dairy was opened at Temesvár in 1899 and the next year others were opened at Dombrovár, Veszprém and Szabadka.

Three or four years after the organisation of these dairies, a certain number of the cooperative creameries, especially the larger ones, were no longer satisfied with the sale of milk but started the manufacture of butter on their own account. At first this new departure proved very remunerative, especially when, owing to the foot-and-mouth disease and the lack of fodder, the yield of milk diminished considerably, both in Hungary and in the neighbouring countries. Nevertheless the foot-and-mouth disease which raged in 1912 revealed clearly that the recent efforts of the cooperative dairies had not yielded good results.

Since 1906 it has been a constant struggle, every year in one part or other of the country, sometimes against the drought and the shortage of fodder, at other times against floods or foot-and-mouth disease. It is natural that these adverse circumstances should lead to an increase in the prices of milk and butter, which in its turn caused the butter from Hungarian dairies, which until then had been for the most part in demand on the Austrian markets, to be gradually ousted by Danish butter, which was preferred for both its price and its quality. The cooperative dairies suffered great losses and at present a number of them have given up making butter and limit their activity to the collecting and carrying of cream. They have thus led to the creation of three new central butter dairies in three counties. The management of these butter dairies has recognized that in order to improve the quality of Hungarian butter it is necessary to adopt all the measures suggested by the progress in scientific technique, and since then the cream has been pasteurized and pure culture starters have been used.

Cooperative dairies do not develop to the extent that would be desirable for the progress of the Hungarian dairy interest. This is to be attributed to the fact that in some parts of the country the small farmer is not convinced of the utility of cooperative dairies. More than once it has happened that small farmers have abandoned the cooperative dairy if in the same commune some dealer has paid a fraction of a penny more for their milk. Still, the commercial spirit of our small farmers is awakening,

and I hope that the principle of cooperation will gradually gain ground among the producers of milk.

As for the production of our cooperative dairies, the following data are available. Since 1897 cooperative dairies have been founded in great numbers; in that year 34 cooperative dairies with 5937 shares produced 420 759 lbs. of butter; their receipts amounted to £ 22 470. At the end of 1913, 573 cooperative dairies were in full activity; they turned out 4 730 000 lbs. of butter and their total trade amounted to £ 418 150.

The new tendency is to increase the milk yield of our cows, which has been judged insufficient. The average yearly yield of the country corresponds to 308 gals. per cow. Comparing these figures with the results obtained in the States of Western Europe, it must be recognized that there is still much margin for improvement in the production of milk in Hungary. The returns of the dairy industry in the States of Western and Northern Europe are twice as great, in Holland even two and a half times as great as in our country.

With a view to increasing the production, milk record associations have been organized. The field of their activity is in the county agricultural societies, where they act as sections for cattle breeding or milk recording.

At present milk recording is carried out in 17 societies, in 36 districts in which 17 000 cows belonging to 635 owners are submitted to methodical control. In one district to which the neighbouring herds are admitted, a milk inspector records the performance of about 500 cows. The inspectors follow a three months course of instruction in milk control, which is held in one of the dairy schools and to which only pupils who have attended a dairy school of the country and who are acquainted with the practice of dairying are admitted. In each county agricultural society, the section of milk records registers the controlled animals in a local herdbook, and cows whose yield attains at least 660 gals. during one lactation are admitted to entry in the national herdbook. In order to defray part of the expenses entailed by the milk control, as well as the salary of the inspectors, etc., the societies or control sections receive in the course of the year, a subvention of 2000 crowns (£ 83 6s 8d) per annum from the Government. The work of the record societies is under the supervision of the Ministry of Agriculture, whose dairy section revises the results submitted in by the milk inspectors. The milk record societies held last year their first national conference, at which a proposal was made to found a central milk recording station as soon as milk recording has been instituted in fifty districts. The duty of this station will be to control the work of the sections.

The record associations are very important in Hungary from the point of view of the increase of the production of milk. The experience gained in the country and abroad shows that the average yield of each cow subjected to record increases by 44 gals. during the very first year. If only 5 per cent of the stock of cows, or 140 000 head, be submitted to systematic control, the surplus of milk will be about 6 173 000 gals., or £ 151 667. Besides the increase of milk yield systematic and economic

g and the keeping of pedigree books, the artificial feeding of calves aimed at (1).

Owing to the constantly increasing importation of cheese, efforts also been made to start cheese factories. Nevertheless as the lack of fodder and the foot-and-mouth disease often hinder the increase of the production of milk, cheese dairying has not yet made much progress. But this branch of the milk industry requires much more experience and technical knowledge and is more risky, than butter making, in which progress is clearly noticeable. The recent increase in the consumption of butter is due to the high prices of lard.

The kinds of cheese made in Hungary are especially Hungarian Emmentaler, Trappist, Romadour and Magyaróvár, the latter resembling the cheese made in the north of Germany. This industry was introduced into Hungary by Swiss cheese-makers who have established themselves in the mountainous parts of the country and make handsome profits. Only these cheese-makers have established their factories by preference in the western parts of Hungary, because in the South the demand for milk has increased, its price has gone up and turning it into cheese is not remunerative. The Emmentaler and Gruyère cheeses are for the most part made in dairies at Répcelak, Bánóc and Nagyszécsény; the soft dessert cheeses made at Sárvár, Pusztadör and Kisbér, and most of the Magyaróvár cheese at the cooperative dairies of Moson county.

The number of milk ewes is about three million. (In 1913 the total number of sheep was 6 600 000). Calculating on an average yearly production of 8.8 gals. per ewe, the total yield may be estimated at 26 400 000 gals., which, at 5.45 *d* per gal., are worth £ 600 000. The ewes' milk is used in the manufacture of Brindza or Liptó cheese (2), much esteemed abroad. In 1913, Hungary exported 55 486 cwt., of it, of the value of 6873.

During the last ten years our exportation of milk and milk products has not kept pace with the increase of the production of milk, and this is due to the increased home consumption of these articles. Only a short time ago, butter, especially in the provincial towns, was used only as a dessert, whereas now it has become a popular article of diet.

The greatest consumer of milk is Budapest; its 900 000 inhabitants consume daily 66 000 gals., or about 0.6 pint per head. In the capital two dairies supply 33 000 gals. per diem; one, which delivers 26 400 gals., is organised on a cooperative basis; the other, which sells 6 600 gals., is a milk stock company. The farmers send their milk to one of the Budapest railway stations and sell it at 9 *d* and 9 ½ *d* per gal. The public consumes 2 ½ *d* per gal. for the best milk in bottles delivered at the consumer's door, and 1 *s* or 1 *s* 1 *d* for milk in cans.

For the last three or four years, among the other large cities of Hungary, Pécsvár and Nagyvárád have also started municipal dairies; but as the

(1) See No. 1029, *B. Nov.* 1914.

(2) See No. 1669, *B. Dec.* 1912.

(Ed.)

(Ed.)

initial difficulties are not yet overcome, we cannot give exact data on the results.

In Hungary the consumption of milk has considerably increased especially owing to the anti-alcohol campaign. The daily consumption per inhabitant may be estimated at a little over half a pint; thus, taking the population of Hungary at 18 $\frac{1}{2}$ millions, the yearly consumption of milk is 446 million gallons, or 55 per cent. of the total amount of milk produced.

Basing our calculations on the available data and taking into consideration the prices of concentrated foods, we have been able to determine the cost of production of milk in this country, which is set forth in the following table:

Cost of production of 1 gallon of milk.

Daily yield gals —	Corresponding cost — s
0.88	9.9
1.10	7.9
1.32	6.6
1.54	5.7
1.76	4.9
1.98	4.4
2.20	5.9
2.42	4.4
2.64	4.9
3.30	4.4

The Control of Plant Diseases in Sweden

by

Prof. JAKOB ERIKSSON, *Stockholm.*

A. — INTRODUCTION.

Many years have elapsed since Sweden began to take measures for the control of plant diseases. The first step in this direction was made in 1876 by the appointment of a Botanist at the Experiment Station of Agricultural Chemistry attached to the Royal Academy of Agriculture and situated at Experimentalfältet near Stockholm. For the appointment of the Botanist the Swedish Riksdag had voted a sum in 1875; this was renewed for a series of years. The Botanist had the duty of making, during the summer, botanical investigations connected with experiments carried out by the Station of Chemistry. On December 1876, the writer was named Botanist.

In 1886 a special Botanical Institute, that is to say the Experiment Station for Plant Physiology (Växtfysiologiska Försöksanstalten)

ided by the side of the Chemical Station. In 1885 the Riksdag had
ed the necessary yearly funds for it. The Botanist became the chief
he new station and was entrusted with the drawing up of the detailed
ations and instructions for the 16 State Seed Control Stations, which
approved, the former in 1886, the latter in 1888. The duties of the
included also the inspection of these Stations during the years 1888
889.

n 1889 there was a disastrous attack of rust on the oats in Sweden:
otal crop of the whole country was about 160 000 tons below the
ge of the preceding ten years. According to a proposal of the chief
Station, the Academy of Agriculture presented to the Government
nuary 20, 1890, the request that a sum of £ 550 be voted for new,
ugh and extensive investigations into this rust during the years
to 1892. On February 14 the Government granted the sum de-
ed and the work began immediately. As assistant for this investi-
a Dr. G. J. Henning was attached to the Station up to April 1894.
In June 22, 1905, the American gooseberry mildew (*Sphaerotheca*
urticae) was observed for the first time in a Swedish garden (at Blek-
n the south of Sweden). In a short time the disease spread to several
localities. In investigating the matter it was found that the disease
been introduced by means of gooseberry bushes which had been sent
t some years previously from a Danish nursery. A leaflet was imme-
ly distributed to put farmers on their guard against the parasite.
eptember 22 the Government enacted a provisional law against the
rtation of gooseberry plants and fresh gooseberries into Sweden.
ie same time the chief of the Station addressed to the Governments
l the countries of Europe in which gooseberries are cultivated, an
alto put themselves on the defensive against the approach of the enemy.
ie course of the following year (1906), the disease having invaded the
bourhood of Stockholm, further measures were taken. The Govern-
allocated a sum of £ 55 for the control of the fungus. On
ember 10 of the same year the Government prohibited, until further
is, the transport within the country of gooseberry plants or parts of
is, with the exception of the fruit. By means of articles in a great
ber of Swedish newspapers the public was warned of the danger that
tened this important crop. The most rapid and efficient measures
recommended for the eradication of the pest. Unfortunately this
al remained without effect. During the succeeding years the disease
ed more and more; at present it is frequent in most of the Swedish
ens. The laws against the importation and transport of gooseberry
es were repealed in April 1910.

Since 1907 the Botanical Station has formed part of the Central Agri-
tral Experiment Station (Centralanstalten för försöksväsendet på
bruksområdet) as Division of Agricultural Botany (Afdelningen
andbruksbotanik). In 1907 also some changes were made as to
buildings, etc., of the Station. A new piece of land for experiments
a new building were placed at its disposal. Since 1914 the Division

disposes of an annual budget of £ 973 10s. Out of this sum the gets £ 410, with a periodical increase of £ 33 for seniority. assistant receives £ 165, and the laboratory help £ 38 10s. For experiments £ 357 10s. are set apart.

On October 2, 1912, potato canker (*Synchytrium endobioticum Chrysophlyctis endobiotica*) was observed in Sweden. Efficient measures were immediately taken to eradicate the disease, and apparently happy results (1).

On October 1, 1913, I retired, having reached the age limit fixed by the law, and on April 24, 1914, my post was occupied by Mr. E. J. Henn, professor at the Ultuna College of Agriculture. Mr. C. T. V. Hammarskjöld is at present attached to the Division as assistant.

B. — WORK OF THE BOTANICAL STATION AT EXPERIMENTALFALTE

a) *Various work.* — During the first years, several experiments of cultures in solutions were made with the object of investigating the influence of certain mineral salts, considered poisonous, on certain plants. But even as early as that some research on plant diseases was made.

At the same period popular pamphlets on various diseases were issued. Such were papers on *Nectria ditissima*, on *Exoascus Pruni*, etc.; they were followed by the publication of special studies, for instance in: on *Typhula graminum*, in 1880 on *Sclerotinia Trifolium*, in 1883 on *Clasporium herbarum*, in 1884 on *Phytophthora infestans*, and in 1885 on *Sclerotium graminis*, *Phragmidium subcorticium*, *Sphaerotheca pannosa*, *Uncinula Aceris* and *U. Tulasii*, *Asteroma radiosum*, *Fusicladium dictyonum* and *F. pirinum*, *Morthiera Mespili* and others. In 1890 a summary of observations made in the course of several years on a great number of the diseases of various plants was published under the title of "Diseases of cultivated plants and the means of controlling them".

Since 1890, the presence of parasitic fungi in the samples sent to the Station has been determined, and information as to the nature of the diseases and on the corresponding treatment is forwarded to the sender of the samples. Whilst the number of such samples rarely reached before 1902, it has often been 300 and 400 during recent years. The highest figure was reached in 1907 when the number of reporters was 464 and the number of specimens and questions was 537.

Besides the above work, the officials of the Station have visited various infected localities of the country to make investigations on the diseases and to give farmers information and advice.

b) *Research on the rust of cereals.* — In 1894 and 1895 the preliminary publications on certain results obtained during the years 1890-1893 appeared. In 1894: "Principal Results of New Investigations into the Rust of Cereals" (2), and in 1895: "On the Specialization of

(1) See B. July 1913, p. 1006, and No. 18, B. Feb. 1914.

(2) According to the wish of the author, the titles of articles published in Swedish are here translated.

in Cereal Rusts", "Favourable Influence of Cold on the Germination of the Spores of Certain Fungi", "Is the Rust-resistance of the various Varieties of Wheat Constant or not?" were published.

A detailed account of the results obtained between the years 1890 and 1893 was published in June 1896 under the title "Die Getreideroste, Geschichte und Natur, sowie Massregeln gegen dieselben". The Report and the detailed account of 1896 were written by the and the assistant of the Station together.

In a series of more or less ample works published successively, after research, and written by the chief of the station, many subjects connected with the rust of cereals were examined in detail. Among these publications may be mentioned the following: in 1896, "Which are the species which can communicate Rust to Barberries?", "New Research in Specialisation, Propagation and Origin of Black Rust", and "Barley Bearing and Propagating Rust"; in 1897, "Further Observations in Specialisation of Black Rust", "New Observations on the Nature of Propagation of Crowned Rust", "Characteristics of the Brown Rust of Cereals", "On the Duration of the Capacity of Germination of the Winter Cereals of Certain Kinds of Rust"; in 1899, "New Studies on the Brown Rust of Cereals"; in 1900 and 1901, "On the Origin and Spread of Cereal Rust by Means of the Seed"; in 1902, "Ist der Timotheengrassrost ein selbständige Rostart oder nicht?", "On the Specialisation of Cereal Rust in Sweden and in Other Countries"; in 1903, "On the Vegetative Parts of Yellow Cereal Rust"; in 1904 and 1905, "Ueber das vegetative Leben der Getreiderostpilze", I-IV; in 1905, "Zur Frage der Entstehung und Verbreitung der Rostkrankheiten der Pflanzen"; and in 1908, "Neue Studien über die Specialisierung der grasbewohnenden Rostarten".

With the preliminary communication of 1894 mentioned above, and finally with the detailed report of 1896, the question of the rust of cereals entered upon a new phase.

From that moment it became evident that among the rusts attacking common cereals (wheat, rye, barley and oats), six different species were distinguished, namely: *P. graminis*, *P. glumarum*, *P. dispersa*, *P. triseti*, *P. simplex*, and *P. coronifera*; and for the commonest grasses, very similar rusts of which had always been regarded as identical to those of cereals, six other species: *P. Phleipratensis*, *P. bromina*, *P. repyrina*, *P. holcina*, *P. Triseti* and *P. coronata*.

In the two above-mentioned publications, the principles of the specialisation of fungi were set forth and discussed. In one and the same species of fungus several different strains may be distinguished; these are distinguished from each other from the biological point of view, and are called "specialised forms" (f. sp.): *P. graminis*, for instance, which attacks wheat and cereals and also a great number of grasses, includes among other strains the f. sp. *Avenae*, living on oats, *Dactylis*, *Alopecurus*, *Milium* and other grasses, but incapable of transmission to wheat, rye or barley.

In the full Report mentioned above, the whole life and cycle of evolution of the different kinds of rust, as well as the essentially different degrees of resistance of the various cereals to the various species of rusts, are described in detail.

The greatest care has been bestowed on the study of the hibernation of these fungi and the appearance of new outbreaks of disease on the following year's crop. It was believed that these two questions were completely solved by the existence of winter spores, and that these spores lived unchanged until the following spring, when they germinated and gave rise to new outbreaks of the disease. The new investigations did not, however, support this opinion generally accepted by the learned. The winter spores alone were not sufficient to solve the problem of hibernation. Numerous observations made in the course of several years led me to suspect the existence of an interior germ of the disease in the grain itself or in the young plant grown from it. These suppositions were presented to the public for the first time in the works that appeared between 1897 and 1900, especially in the memoir "On the Origin and Spread of the Rust of Cereals by means of Seed" (1900-1901).

In these publications the hypothesis was advanced that the fungus was present in the cell of the host in a special state; that it lived in the form of a plasma, and that it contracted a kind of symbiosis with the protoplasm of the cell. It is this association which has been called "mycoplasma". At a certain period of development of the host plant, during a certain season, and when external conditions (heat, moisture, light, etc.) are favourable, the mycoplasma abandons its state of plasma, issues from the cell and forms a perfect spore-bearing mycelium giving origin to pustules.

In 1902 and 1903 this hypothesis was subjected to a scrupulous examination, in which the new methods of cytological preparation were applied. Dr. G. Tischler, lecturer at the Heidelberg University, took part in these investigations as collaborator during both summers. The results of the cytological investigation were published in a series of memoirs under the title "Ueber das vegetative Leben der Getreiderostpilze", I-IV (1904-1905), in which the phases of the vegetative life of these fungi are described.

It was easy to foresee that a new theory as subversive as this would meet with opposition. This opposition led to answers on my part, published in the memoirs of 1904 and 1905, as well as in several special pamphlets including the following: in 1903, "The Researches of Professor H. Marschall on the Brown Rust of the Bromes and the Mycoplasma Hypothesis"; in 1904, "Ueber die Mycoplasmatheorie, ihre Geschichte und ihren Tödtend"; "F. Zach's cytologische Untersuchungen über die Rostflecken des Getreides und die Mycoplasmatheorie"; in 1912, "Rostige Getreidearten und die Ueberwinterung der Pilzspecies"; and in 1914, "On the Appearance of Rust Spores and Mycelium in the Seeds of Cereals".

c) *Studies on other kinds of rusts.* — In 1898 a note entitled "Study of *Puccinia Ribis*", containing the history of the development of this fungus, was published.

In 1896 appeared a pamphlet: "Some Observations on the Vescic Rust of Weymouth Pine". In this it is shown that the relationship between *Peridermium Strobi* and *Cronartium ribicola* is not always sufficient to explain the occurrence of this rust. On both kinds of hosts (*Pinus* and *Ribes*) the fungus can live from one year to another if one of the hosts is absent, or when the distance between them is 20 or more miles.

Hollyhock rust (*Puccinia Malvacearum*) has for a length of time been the object of very extensive research; the results are published in two papers, one of 1911 under the title "Der Malvenrost, seine Verbreitung, Entstehung und Entwicklungsgeschichte", the other of 1914 bearing the title "Experiments of Immunisation of the Hollyhock against Rust". It is the first work that the reappearance of the disease on the new hosts cannot be sufficiently explained by the fungus spores. Two forms of the rust have been recognized, similar to each other morphologically but having a different way of infecting. The second work shows that the activity of the fungus living in the latent state in the inside of plants, may be checked or weakened by introducing a liquid fungicide into the roots of the host plant or by watering the soil in which the hosts live with a weak solution of sulphate of copper.

d) *Studies on other plant diseases.* — During the years 1898-1902 a disease attacking several root crops and known under the name of *Rhizoctonia violacea* was studied. The results of these investigations were published in 1903: "Some Studies on *Rhizoctonia violacea* on carrots", and in 1913: "Studies on the Disease caused by *Rhizoctonia violacea*" (1).

Since 1905 extensive research has been carried out on the American gooseberry mildew (*Sphaerotheca mors-uvae*). The results of these investigations are published in about thirty papers, among which we quote the following: in 1905, "The American Gooseberry Mildew in Sweden", "The American Gooseberry Mildew, its Nature, its Propagation, and the Means of Controlling it"; in 1908, "Stachelbeermehltau und Stachelbeerkultur"; in 1909, "Einige Versuche das Winterstadium des amerikanischen Stachelbeermehltaues mit Fungiciden zu töten", "Die verschiedene Empfänglichkeit der Stachelbeersorten im Kampfe gegen den Amerikanischen Stachelbeermehltau".

Two of the most destructive diseases of fruit trees, *Monilia fructigena* and *M. cinerea*, have been the object of continued research (2). We mention here the publication: "Zur Kenntniss der durch *Monilia fructigena* hervorgerufenen Blüten- und Zweigdürre unserer Obstbäume".

In another equally destructive enemy of fruit trees, the apple mildew (*Sphaeria leucotricha*), a communication was made in 1908 in the paper: "Apfelmehltau und seine Bekämpfung".

A new disease which until then had not been observed, caused by

¹ See No. 426, B. April 1913; and B. July 1913, p. 1007.

² See B. July 1913, p. 1007.

Exosporium Ulmi, was the object of minute investigation during the years 1905 and 1906. The result was published in 1912 in a paper "Ueber *Exosporium Ulmi* n. sp."

During recent years several potato diseases have been studied. In 1912 the results of an examination of the felt disease of potatoes (*Hypochochaetum Solani*, *Rhizoctonia Solani*) were published in the article "Felt Disease of Potatoes" (1).

In order to ascertain the influence of a solution of formalin spread in the soil in which potatoes grew, on potato canker or black scab (*Synchytrium endobioticum* or *Chrysophlyctis endobiotica*) some special cultures in boxes were organized during the summer of 1913.

In 1912 a summary of the results of research carried out for many years on the diseases of beets was published. This work bears the title "Fungus Diseases on Swedish Beet Crops" (1). A more detailed report of one of the diseases (*Uromyces Betae*) mentioned in the said work, was given in 1914 under the title "Some Studies on Beet Rust".

A summary of research concerning the diseases of cucumbers (1), published in 1913 in the work "Fungus Diseases of the Swedish Cucumber Crop".

In 1910 I published a manual bearing the title "Landtbrukets svampsjukdomar". In 1912 an English edition, revised and somewhat enlarged, appeared under the title of "Fungoid Diseases of Agricultural Plants". A German edition "Die Pilzkrankheiten der landwirtschaftlichen Kulturpflanzen" was published in 1913, and a French edition "Les maladies cryptogamiques des plantes agricoles et leur traitement" in 1914.

e) *Efforts for the establishment of international collaboration with a view to controlling the diseases of cultivated plants.* — The idea of such international collaboration was mooted for the first time in 1890 at the International Congress of Agriculture and Forestry at Vienna. At that time I presented a proposal aiming at an international agreement for the defence against such diseases. A great number of motions all tending to the same aim have been presented since at International Congresses: Paris (1901), Rome (1903 and 1905), Vienna (1907), Rome (1907 and 1908), Montpellier (1908), Rome (1909, 1910 and 1911), Paris (1912) and Rome again for the eighth time in 1913.

In view of an efficient control of plant diseases, a Bill was prepared in Sweden in June 1913, and the Swedish Government is having it examined.

But the most important diseases, those which are responsible for at least 90 per cent of the yearly losses, cannot be advantageously controlled by legislative measures. In a Report presented to the International Conference on Phytopathology (held in Rome from February 24 to March 1914) and bearing the title "Phytopathological problems: the different diseases require different measures", I called attention to this important fact.

(1) See B. July 1913, p. 1007.

C. — WORK OF OFFICIAL BOTANICAL INSTITUTIONS.

At the Ultuna Agricultural College, near Upsala, prof. Henning has studied some fungi and insects injurious to crops; he has besides given information as to the methods of controlling them and has published works on these subjects.

At the Alnarp College of Agriculture, near Lund, Prof. T. Hedlund has studied several parasitic fungi and especially those of root crops. He has also published reports on the results obtained by his research and he has distributed papers dealing with these subjects among farmers.

In connection with the extensive work for the improvement of seed carried out by the Svalöf Station for Seed Improvement (Sveriges Svalöfsförädlingsstation i Svalöf) several plant diseases have been studied. Reports upon this work have been published by officials attached to the Institution, and especially by Dr. H. Nilsson-Ehle and Dr. H. Tedin.

The State Forest Experiment Institution (Statens Skogsförsöksanstalt, Stockholm) has commenced of late years investigations in forest pathology. Memoirs concerning diseases of conifers and some other subjects have already been published. These publications are due to the staff of the Institution, Dr. G. Lagerberg.

SECOND PART.
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1086 — Report of the Work of the Experiment Stations and Experiment Field Annam, 1913. — DEVRAIGNE, GEORGE (Chef des Services Agricoles et Commerciaux de l'Annam) in *Bulletin économique de l'Indochine*, Year 17, No. 108, pp. 313 Hanoi-Haiphong, May-June 1914.

I. — *Experiments with industrial plants.* — The Caravonica var of cotton was experimented with at the station of Hué. It is a resist variety and makes good growth, but has the disadvantage that it does not reach maturity during the rainy season. Attempts will be made to remedy this as far as possible by suitable pruning. Kapok from Venezuela was very successful, whilst that from the Malay peninsula and Cambodia was less successful. The oil-yielding *Camelia* (1) was successful at the Vinh Station (north Annam), but it was not a success at the Hué station (South Annam), where the climate is very different. Amongst rubber trees *Ficus elastica* and the liana *Cryptoslegia madagascariensis* have succeeded at Hué; *Funtumia elastica* was less successful and Hevea was a failure. *Arenga saccharifera* succeeded well at Hué and in groups of three the trees resisted the most violent winds and typhoons; it is fairly abundant in the forests of Annam and its fibres are used to a small extent by the natives. Camphor grows exceedingly well at Hué, and Kola nuts, *Merremia mamosa* and *Curcuma* were also successful.

II. *Experiments with food plants.* — In 1912 an orchard was established at Hué with native and exotic species, including bananas, shade

(1) Various species of *Camelia* such as *C. drupifera*, *C. Sasanqua*, *C. theiiera*, are used for the extraction of oil from the seeds. Cf. WATT, *Dictionary of Economic Products of India*. Calcutta.

ange, mangosteen, pineapple, papaya, cacao, pepper, etc. Experiments the cultivation and selection of rice have been in progress since 1906 the Yên-dinh Station. The results obtained each year from 1906 to 13 are summarised in tables by the writer. During the last year (1913, variety "Lua Chanh", an early hill rice, yielded 1242 lbs. per acre) whilst various selected swamp rices yielded from 1242 to 2737 lbs. per acre.

III. — *Animal breeding.* — At the Hué Station the acclimatisation of breed of Kélanian sheep from Yên-dinh was very successful. The worm egg-breeding stations founded by the Government continue to increase: during 913 they numbered 11 and distributed 636 293 batches of eggs.

CROPS AND CULTIVATION.

1. — *The Climate of Ethiopia.* — EREDIA, F., and DE CASTRO, L., in *Bollettino della Reale Società Geografica*, Part VIII, pp. 845-884. Rome, 1914.

AGRICULTURAL
METEOROLOGICAL

There is little information concerning the climate of the high plateau Abyssinia, the only data available being those of DOVE obtained 1890 (*Kulturzonen von Nord Abessinien, Ergänzungsheft Nr. 97 zu Hermanns Mitteilungen*, Gotha, 1890), those published in the *Annales de l'Observatoire physique Central Nicolas*, Petrograd, 1898-1903; those collected by LYONS, etc. All these observations have the disadvantage of having been made during limited and irregular periods.

In October 1901 Dr. L. DE CASTRO established a meteorological station at Addis-Abeba, where he began a series of regular observations which, together with Dr. E. ODDONE, he continued until 1911. The data thus obtained have been examined by Prof. FILIPPO EREDIA and summarised in the accompanying table.

The difference between the highest and lowest mean monthly temperatures (18.7° and 14.6°) is very slight; thus the climate is mild and the mean temperature almost uniform throughout the year. The difference between the day and night temperatures, on the other hand, is very great and averages 15°C . The maximum daily temperatures during the hottest period are almost 35°C . whilst the night temperatures during the coldest months approach zero.

The rainfall shows a very distinct period of abundant rain from the last ten days of June until the second ten days of September, the heaviest rainfall being during the first ten days of August. This period of dense rain is followed by an interval where the rainfall is less abundant, beginning suddenly and lasting until the end of February. Extreme drought occurs in January, when no rain has ever been recorded during the first ten days. This period is followed by more abundant rains, which increase as the rainy season approaches. The rains may be divided into two classes: the less abundant and prolonged rains during the period of heavy rainfall and the more abundant short rains during the rainy season. Heavy rains are almost always accompanied by electrical disturbances.

which are particularly frequent in the afternoons. At the same time the wind is generally from the S or SW, whilst the storms come from the N or NE and sometimes from the E. The heavy rains should therefore be attributed to opposing currents of air, whilst light rains may be considered as entirely of orographical origin.

During the rainy season the predominant winds are N, W and N

Summary of the Climatological Data of Ethiopia.

(Temperatures in deg. C., rainfall in mm.)

Month.	Mean temperature				Extreme temperature		Rainfall		Fine days	Relative humidity	No. of rainy days
	daily	max.	min.	range	max.	min.	quantity	No. of rainy days			
January	15.5	24.2	6.8	17.4	28.0	3.0	12.5	3.8	22	53	8
February	17.0	25.3	8.6	16.6	30.0	3.5	33.1	2.9	20	54	SE
March	18.3	26.3	10.3	16.0	29.5	5.0	67.7	9.7	15	61	S
April	18.0	25.6	10.4	15.2	32.0	6.0	75.4	12.0	11	70	SE
May	18.7	26.7	10.7	15.8	33.0	4.0	75.9	9.1	15	58	1
June	17.7	25.3	9.9	15.4	34.0	7.0	128.9	29.9	8	73	8
July	16.6	23.0	10.3	12.7	31.0	7.0	266.1	28.3	2	78	1
August	16.2	22.1	10.1	12.0	29.0	7.0	316.4	28.6	2	87	1
September	16.5	23.1	9.8	13.3	38.0	6.5	188.3	23.2	7	85	8
October	16.6	24.8	8.4	16.4	33.0	4.0	18.2	3.9	20	63	1
November	15.0	23.3	6.8	16.5	27.5	1.5	21.3	2.5	23	53	1
December	14.6	23.1	6.0	17.1	28.0	0.0	8.8	2.2	24	45	1
Year	16.7	24.4	9.0	15.4	38.0	0.0	1212.6	148.1	169	665	1

There is also a distinct daily variation; in the mornings the N and S E winds predominate, changing to the N in the evening. At the end of the period of heavy rains is marked by the predominance of N E and E winds, those of the S W and S disappearing almost completely.

The seasons are described as follows:

Winter (October, November, December): low temperature; little daily variation; high variation daily; minimum relative humidity; large number of fine days; prevailing wind E.

Spring (January, February): mild temperature; relative lack of daily variation; high daily variation; minimum relative humidity; large number of fine days; predominant wind: S E.

Summer (March, April, May, June): high temperature; relative lack of daily variation; average daily variation; average relative humidity; large number of fine days; predominant wind S E.

Autumn (July, August, September): mild temperature; abundant rain; minimum daily variation; high relative humidity; very few fine days; dominant winds; N and S E.

The natives divide the seasons according to their rainfall, the four seasons in the above order being known as Tebbi, Hagai, Todi and Kerempt.

8 - **The Estimation of Phosphates in Soil Extracts.** — PRESCOTT, J. A. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, Part 2, pp. 111-120. Cambridge, May 1914.

The method of estimating phosphates recommended by the United States Division of Chemistry, which consists in dissolving the phosphomolybdate precipitate in excess of standard alkali and titrating back with standard acid, was examined with regard to certain working conditions. It was shown that it is essential to avoid working at too high a temperature, 55° C. proving most favourable. The presence of silica also proved a disturbing factor and this substance should be precipitated in the preliminary phases of the estimation. Determinations made with solutions containing known amounts of phosphate yielded results 3 per cent too high when the calculations were based on the usual factor (1 cc. $\frac{N}{10}$ alkali = 0.0003088 gm. P_2O_5) and it is therefore recommended that the factor 1 cc. $\frac{N}{10}$ alkali = 0.0003004 be adopted, as it corresponds approximately to the constitution $48 Mo O_3 \cdot 2 P_2O_5 \cdot 5 (NH_4)_2O$ for the yellow precipitate.

Another method of estimating small quantities of phosphate was also examined; it consists in converting the phosphomolybdate precipitate into dimolybdate and weighing it as such; it was found to be no more accurate than the titration method, while being less rapid.

9 - **Azotobacter in Connection with Nitrification.** — HEADEN, W. P. (Colorado Experiment Station) in *Science*, Vol. XI, No. 1028, pp. 379-381. Garrison, N. Y., September 11, 1914.

In certain pure cultures of *Azotobacter*, brown pigmentation was obtained; this tended to weaken and disappear in the successive generations. Where such pigmentation occurred a decided reaction was obtained with phenolsulphonic acid apparently indicating the presence of nitrates and consequently a power of nitrification on the part of *Azotobacter*. Further investigation, however, it was found that the colour reaction was due to the pigmentation and not to the presence of nitrates, thus destroying all evidence of nitrifying power on the part of *Azotobacter*.

10 - **Overhead Watering Plant.** — DEAN, WILLIAM HARPER, in *The Country Gentleman*, Vol. LXXIX, No. 31, pp. 1309-1311. Philadelphia, August 1, 1914.

Among the many systems of irrigation, the overhead system presents several advantages, namely that it can be used on sloping uneven ground where surface irrigation would be difficult to apply, that it can be used to distribute liquid manures, and that sprays for the control of plant diseases and injurious insects can be applied easily, evenly and efficiently.

The writer, in company with the U. S. Government irrigation engineer in charge of irrigation investigations in the States east of the Mississippi,

SOIL PHYSIC
CHEMISTRY
AND
MICROBIOLOG

PERMANENT
IMPROVEMENTS
DRAINAGE
AND
IRRIGATION

visited some farms irrigated on this system and reports upon two among the most successful of them.

The first is situated in Central New Jersey. It is a farm which 9 acres are irrigated by this system and 19 by surface irrigation; most of the land is under strawberries and orchards. The water is pumped up from a river by a 24 HP. gasoline engine. The pump, plant, pump house and connection to the mains carrying water to the fields cost \$778. The rest of the irrigation plant for the first five acres cost in 1910, \$1162 distributed as follows:

Pipe materials all galvanized	\$ 852
Freight on pipes and incidentals	25
Patented fittings	143
Posts for spray lines	52
Day labour at \$ 1.25 per day	50
Plumber at \$ 3 per day	40
	<hr/>
	\$ 1162

The second part of the installation for the next 4 acres cost \$14

From the pumping plant a 5-inch galvanized steel main carries water under 30 or 40 lbs. pressure to the overhead pipes. These pipe lines are 425 feet long and 50 ft. apart, supported every 40 ft. by upright steel pipes. In order to ensure the same pressure throughout, the diameter of the pipes varies from 1 1/2 inch to 3/4 inch.

By a slight turn of a lever the whole length of these pipes may be turned to change the angle of the tiny spray nozzles that are situated four feet apart in each pipe; roller bearings on each line make this possible. During irrigation the angle of these nozzles has to be changed seven times to get the rain evenly distributed over the space between the lines.

This system supplies 40 gals. a minute to the acre; it would put one inch of water on the land in about 12 hours.

The second farm visited is situated in Southern New Jersey; it covers 20 acres, 10 of which under overhead irrigation. The land is level and the soil a light, poor sand.

The water is pumped up from a creek by a 12 HP. gasoline engine and is distributed at 20 lbs. pressure. The overhead lines are 250 feet long and 50 ft. apart. The supports are 20 ft. wooden posts 125 ft. apart; from the tops of these poles were stretched cables from which are suspended the spray pipes by means of other wires. Twelve gallons a minute come out through the nozzles for the first half of each spray line, and half of this for the second half, at which rate an inch of rainfall can be put down in 12 hours.

The average cost of the plant is \$250 per acre. Depreciation is very low being chiefly limited to the pump and engine and to the wooden supports for the spray lines.

In this farm concentrated Bordeaux mixtures or Paris green wash poured into the system of pipes while clear water is running through, and 20 minutes 1 1/2 acres can be sprayed. Liquid manures are applied the same way.

Irrigation Scheme for Sindh; The Development of Cotton. — SUMMERS, T. (Proceedings of the East-India Association), in *The Asiatic Review*, Vol. V, No. 11, pp. 298-330. London, October 1914.

The low productivity of this large tract of the Indus Valley appears due to the low rainfall, which varies from 2 to an average of 6 inches. The soil of the Sind consists of alluvial silt deposited by the Indus, and in some places (about 500 B. C.) its fertility was increased by an excellent irrigation system which enabled it to support a much greater population. At the present time, a few canals exist only on the lowest tracts, only one-fourth of the area is cultivated, the cultivators lift comparatively silt-water on to their fields at a cost of 5 rupees or more per acre, and a population of 800 000 persons cultivates only 600 000 acres.

The writer describes a scheme, known as the Rohri Canal Project, which, if carried out, will bring into cultivation between one and two million acres of fertile land, of which half to three-quarters of a million acres will be suitable for cotton and capable of supporting twenty or thirty cotton crops.

The cost of this scheme is estimated at about 10 millions sterling at the present rate of assessment the net annual profit to the Government would amount to between $\frac{1}{4}$ and $\frac{1}{2}$ a million sterling.

Experiments in Tilling the Soil by Means of Explosives. — I. SPRING, F. G. Dynamite Experiment. — *The Agricultural Bulletin of the Federated Malay States* Vol. II, No. 11, pp. 297-299. Singapore, June 1914. — II. DURHAM, HERRERT E. On the Use of Explosives in the Garden, in *The Journal of the Royal Horticultural Society*, Vol. XL, Part I, pp. 7-18. London, August 1914.

TILLAGE AND
METHODS OF
CULTIVATION.

I. In October, 1913, some experiments were made at the Experimental Station, Kuala Lumpur (Federated Malay States), on the use of explosives in rubber cultivation. The land on which they were carried out is poor laterite nature and the rubber plants were very backward in growth. The results are those hitherto obtained from an area subjected to routine charges.

Three parallel rows of rubber, each containing 34 trees, were selected; in the middle row the explosive was used, while the other two were kept as controls. Cartridges were placed at a depth of 2 $\frac{1}{2}$ feet below the surface of the ground, one cartridge between two trees 12 $\frac{1}{2}$ feet apart. The method of firing was by means of fuses and detonators.

The average increase of girth measured on June 9, 1914, was 2.56 inches in the dynamite row and 1.81 and 1.62 in the control rows. The cost of firing the explosive is 15 cents per charge, inclusive of labour. One charge per tree is generally allowed. The results would have been more evident if the subsoil had been of a clay nature, as is the case at Castleton Estate, where an experiment on a much larger scale is being conducted.

II. The writer wished to ascertain whether explosives can be used for tilling the subsoil on small areas, such as gardens intensively cultivated, or for buildings. He used "cheddite" cartridges with 2 oz., 1 $\frac{1}{2}$ oz., 1 oz., and $\frac{1}{2}$ oz. charges placed three feet apart and at a depth of three feet. One of the ground had recently been double dug before the exploding

and it was obvious that much of the force which would have been utilised if the ground had not been spaded was wasted.

Compared with the control plot not loosened by cheddite, the *po* Crimson Beauty showed that the response to the explosive was marked. Thus the $\frac{1}{2}$ oz. charges gave about 15 per cent. increase, the 1 oz. charges about 43 per cent and the 2 oz. about 88 per cent. Cauliflowers and cabbages showed no appreciable difference on exploded and unexploded ground. With the number of plants was much smaller on the unexploded side, on which they blossomed and matured a week earlier than on the exploded ground. Carrots, onions and scorzoneras gave a greater number of plants, and generated and developed much better on the exploded ground; with the last plant especially the crop was much increased by the explosive. Asparagus the shoots were not far from having been doubled in length.

As for the cost: at wholesale prices, four or five 2 oz. shots including fuse and detonators can be had for a shilling. With regard to the energy developed by cheddite, allowing 50 per cent loss of the total available energy, a 2 oz. charge gives about 50 400 foot-pounds in the soil, that is quite times as much energy as would be put into the soil by using the spade to a depth of three feet.

1093 - **The Relative Effect of Lime as Oxide and Carbonate on Certain Soils**
HUTCHINSON, H. B., and MAC LENNAN, K., in *The Journal of Agricultural Science*, Vol. VI, Part 3, pp. 302-322, plates IX-X. London, September 29, 1914.

To make a further study of the hitherto not fully known mechanism of the changes wrought by caustic lime in the soil, five soils of widely different type were taken:

1. *Rothamsted soil*, a poor stiff clay containing 7.72 per cent of organic matter (loss on ignition) and 1.94 per cent of CaO.
2. *Chelsea soil*, a black sandy soil containing 14.32 per cent of organic matter and 1.42 per cent of CaO.
3. *Craibstone soil* (Scotland), a light soil, rich in organic matter (18 per cent), with 0.41 of CaO.
4. *Millbrook soil* (Woburn), a very light sandy soil, poor in organic matter (4.46 per cent), with 0.26 of CaO.
5. *Woburn soil*, an open sandy loam, which has been rendered distinctly acid by annual applications of sulphate of ammonia for the last 37 years; it contains 4.58 per cent of organic matter and 0.56 per cent of CaO.

Laboratory Experiments.—The soils were passed through a 3 mm. sieve and filled into bottles in lots of 900 gms. A set of bottles from each soil was set aside as control, and the others received calcium oxide in the proportion of 0.1, 0.2, 0.3, 0.4, 0.5 and 1.0 per cent, while calcium carbonate was added to another lot to the extent of 1.0 per cent, with the exception of the Craibstone soil, where applications of 0.3, 0.6 and 0.9 per cent of carbonate were made. The water content was made up by means of sterile water to 18 per cent. A set of bottles was taken immediately after the end of this ten-day treatment, and the others were stored, provided with cotton wool plugs, at room temperature. The various soils were examined once a month; the number of bacteria was determined, as well as

count of ammonia and nitrates produced. Examinations for protozoa were also made.

Pot experiments — The soils were passed through a 3 mm. sieve previous being filled into glazed earthenware pots (in which loss by drainage was prevented) at the rate of from 8 to 10 kg. of soil per pot. Lime as oxide or carbonate was applied in the same ratio as in the laboratory experiments. The surface soil was then wetted with 100 cc. of water in order to allow efficient action of the caustic lime before it became carbonated. Ten dry seeds were sown in each pot, and after about a month the plants were thinned out to five per pot. Equal numbers of the seedlings were weighed to ascertain the initial effect of the lime on plant growth.

The results are given in numerous tables and diagrams and are summarized as follows:

Caustic lime is found to have two distinct effects on the soil:

1) A partial sterilisation effect.

2) A chemical action, decomposing some of the soil organic matter.

The amount of caustic lime necessary to induce specific changes in the flora and fauna of the soil depends very largely upon the character of the soil. The light sandy Millbrook soil, poor in organic matter and in carbonate, reacted sharply with 0.2 to 0.3 per cent. caustic lime; the Rothamsted clay soil, poor in organic matter but rich in carbonate, was found to react to 0.3 to 0.4 per cent; the acid Woburn soil required between 0.5 and 1.0 per cent, as did also the rich Chelsea garden soil, which already contained carbonate; the Craibstone soil, with a high organic and a low carbonate content, failed to react even to applications of 1.0 per cent caustic lime.

Each of these soils, as well as many others examined, appears to absorb directly a definite amount of caustic lime, and until these requirements are fully satisfied the partial sterilization phenomena do not set in. These phenomena include a sudden initial decrease and subsequent increase in the numbers of bacteria, the extinction of the larger forms of protozoa and the inhibition of nitrate production. Lower doses than those required for partial sterilisation induce a temporary suspension of nitrification, and subsequent accumulation of ammonia, for periods varying with the amount of lime and the character of each soil; they also lead to a temporary increase in numbers of bacteria capable of growing on gelatine plates, but these afterwards decrease, until the level of the untreated soil is reached.

Caustic lime causes chemical breaking down of some of the organic matter of the soil, as shown by the ammonia formed during periods when the bacteria are quiescent; when, however, bacterial growth commences, there is a large increase in the rate of ammonia production.

The return in nitrogen, as ammonia and nitrate for each increment of lime applied, varies with the character and reaction of the soil and the carbonate content. On the average, and within a period of about 250 days, it amounted approximately to 1.0 per cent by weight of the caustic lime applied. Carbonate gave less returns, apparently because of its relative inaction on soil organic matter.

The pot experiments show amounts of available nitrogen in the soil comparable with the amounts of ammonia and nitrate produced in the laboratory experiments. In some cases the amount of caustic lime applied was sufficiently large to check the growth of bacteria and to depress plant growth in the first crop, but in the case of the Chelsea soil the bacteria were active but plant growth was depressed, a phenomenon not yet satisfactorily explained.

As in other experiments, inhibition of nitrification resulting from applications of lime leads to a higher nitrogen content in the plants. This has been ascribed to the assimilation of nitrogen compounds other than nitrates, and, if occurring to any extent, involves an uneconomic utilisation of soil nitrogen. Where the amount of lime does not check nitrification, as in the case of the lighter dressings to the Craibstone soil, the nitrogen content of the plants is about the normal.

1904 — **The Duration of the Action of Manures.** — HALL, A. D., in *The Journal of the Royal Agricultural Society of England*, Vol. LXXIV, pp. 119-126. London, 1913.

A set of experiments was started at Rothamsted in 1904 in order to obtain practical information on the duration of action of manures. It took the following form: for each manure five plots were set aside; one was a check plot which at no time received the manure under investigation; of the other plots, one received the manure in 1904, but remained unmanured in 1905, 1906 and 1907; a second plot was manured in 1905, but not in 1906 and 1907; the third in 1906, but not in 1907; the fourth in 1907. Then in 1907, by which year the experiment was in full swing, there was a plot that had been manured in that year, another that had been manured in the previous year, a third two years previously, and a fourth three years previously. In 1908 it was considered that the manure applied in 1904 to the first plot had been exhausted by the four crops grown with it, and the manure was renewed on that plot; on the second plot it was renewed in 1909, and so on. The field was farmed on a rotation of alternating corn and roots and contained eight sets of five plots; follows:

Nitrogenous manures:

1. Dung made from roots and hay only.
2. Cake-fed dung.
3. Shoddy (wool waste).
4. Peruvian guano.
5. Rape dust.

Phosphatic manures:

6. Bone meal.
7. Superphosphate.
8. Basic slag.

Once during each rotation a dressing of superphosphate and sulphate of potash was applied equally to all the nitrogen plots; similarly for the root crops a dressing of sulphate of ammonia was given alike to all the phosphatic plots. The unmanured plot in each series was so placed in the line that together they formed two diagonals across the field and the mea-

the first five was used for comparison in the case of nitrogenous manures, the mean of the last three as the standard for the phosphatic plots.

The results are considered under three headings.

1. *Residual values of rich and poor dung.* (1) — In the year of application, the cake-fed dung showed a great superiority over the roots and hay dung, but this superiority was much less manifest the second year and entirely disappeared the third and fourth year, though the effect of the dung persisted in both cases, raising the yield above that of the unmanured plot. These results are due to the fact that both kinds of dung contain approximately the same amount of insoluble nitrogen, while the cake-fed dung is richer in ammonia and amides, the effect of which had completely disappeared after the second crop.

2. *Other nitrogenous manures.* — The relative total produce of the other three nitrogenous manures is given below, the unmanured plot in each case being taken as 100.

	Year of application — Mean of 9	1 year old residue — Mean of 8	2 year old residue — Mean of 7	3 year old residue — Mean of 6
shoddy	139.7	125.2	116.1	106.7
Peruvian Guano	130	101	96.5	94.4
rape dust	136.2	100.4	100	94.4

A marked contrast exists between the shoddy on the one hand and Peruvian guano and rape dust on the other. The shoddy evidently contains compounds of nitrogen subject to comparatively slow decay, so that its effect in the second and succeeding years is considerable, there being a distinct increase indicated in the fourth crop grown with the manure. Indeed, the values yielded by shoddy compare very closely with those obtained with farmyard manure made from roots and hay only. It is a persistent manure that exerts in the first year of application less than one-half of its total effect. Doubtless we should include in the same category all manures made from hair, fur, skin, silk, hoofs, horns, etc.; and probably also the nitrogen compounds of bones.

Very different are the results yielded by Peruvian guano and rape dust. In both these manures the return in the first season is high; they are well known as active and effective nitrogenous fertilizers; but the experiments show that they leave no residue possessing any value for succeeding crops. Owing to the limited number of experiments, too much stress cannot be laid on the actual figures obtained, but it may be concluded that the nitrogenous residue from Peruvian guano or rape cake after a crop has been taken will give less than 10 per cent. increase in the second crop, and after that

(1) See No. 15, B. Jan. 1914.

will be completely exhausted. (It should be noted that this statement applies to the nitrogenous part only of these manures, not to the phosphates they contain). Now the nitrogen compounds in question are, in the guano, ammonium compounds, uric acid and its derivatives, and some proteins; in the rape cake, almost entirely proteins; and it is a point of great importance in this connection thus to find that proteins are as active and as temporary in their action as ammonium compounds. Such a result is indeed intelligible, for the true proteins are readily and completely digestible and are equally easily attacked by bacteria, and pass thereby into ammonium and kindred bodies with great rapidity. There is other evidence from the Rothamsted experiments that the nitrogen in rape cake is, pound for pound, very nearly as immediately effective as the nitrogen in ammonium salts. The proteins thus fall into line with nitrates, ammonia, urea, etc., as compounds which produce all their effect in the season of their application, and leave little appreciable residue behind, in contrast to the collagens (the insoluble nitrogen compounds of wool, skin, bone, etc.) and to the indigestible residues of food. With this distinction in mind, the residual value of the nitrogen in other fertilizers can be roughly estimated: in cakes and seed residues it will be present in the form of protein; in fish guanos, it will be mainly protein; in meat guanos, protein and collagen, the latter predominating the poorer the manure becomes and the more it approximates to bone meal. Though these conclusions are based on experiments on the Rothamsted soil alone, it is one that would usually be considered retentive of manure, being both heavy and cool, fairly supplied with rain but not waterlogged.

3. *The phosphatic fertilizers.* — The following table shows the relative total produce yielded by the three phosphatic fertilizers, the unmanured plot in each case being again taken as 100.

	Year of application — Mean of 9	1 year old residue — Mean of 8	2 year old residue — Mean of 7	3 year old residue — Mean of 6
Superphosphate	116.2	109.1	113.8	107.8
Bone meal	114.6	112.4	109.1	105.6
Basic slag	114.5	110.5	104.8	112.0

These results are significant in two directions: 1) that the phosphatic manures persist in the soil, and the residues exert an effect roughly proportional to the amount of phosphate unused; 2) that superphosphate is as lasting a manure as either bone meal or basic slag. These conclusions are perhaps limited to a soil like the Rothamsted reasonably well furnished with carbonate of lime, so that the compounds formed in the soil by the soluble phosphoric acid will be mainly those containing lime. With regard to the original object of these experiments, it is clear that the

compensation to be paid for a dressing of phosphatic manure must be spread over a longer period than that given for most kinds of nitrogenous fertilizers.

Phosphatic manures are usually applied in considerable quantity; with the ordinary dressings it may be assumed that at least one-half of the original value of the manure remains in the soil after the first crop has been taken, and compensation to that extent should be given to the outgoing tenant, always assuming that the soil is one needing phosphatic fertilizers, so that the original expenditure was justified. When phosphatic fertilizers are used on suitable grass land, the scale of compensation should be even higher and should last for more than four years, because of the cumulative change wrought in the herbage as well as the actual phosphoric acid left behind.

105 - **Prohibition of Collection of Guano in the Ballestas Islands, Peru.**

La Riqueza Agrícola, Vol. IV, No. 27, pp. 161-163. Lima, Peru, 1914.

Owing to the steadily increasing consumption of manures in the development of Peruvian Agriculture, it has been necessary to restrict the exportations of guano from the country (1).

In 1890 the Peruvian Corporation obtained the rights of exploiting the existing deposits, but later deposits were reserved to the native cultivation. As the demand for guano increased in Peru, owing either to the exhaustion of the soil in cultivation or to the extension of the area of land under cultivation or to the adoption of more intensive methods, or to the better education of the rural classes, the simultaneous exploitation of the guano deposits presented great difficulties, since the agricultural interests, which had insufficient command of labour, were injured by the Peruvian Corporation which extracted the largest quantity of guano with the highest percentage of nitrogen. As a result of this, by decree of the 25th February 1909 (promulgated for that particular year but which remained in force till 1914) the guano deposits were divided into two zones: north of Callao for the "Peruvian Corporation" and south of Callao for the country requirements, except the Ballestas Islands and Lomita Point, which were included in the first zone. This decree however did not remedy the unfair distribution of the product, to the detriment of the agricultural community, shown in the following table.

This table shows that the Peruvian Corporation extracted six times the quantity of guano obtained for the agricultural community of the country.

Consequently a new Government decree of February 5, 1914 declared the deposits of the Ballestas Islands to be reserved for the three years, after which period they are to be worked for the benefit of the farmers.

This is considered to be the first step towards supplying the needs

(1) See B. February 1914, No. 107. — Also: International Institute of Agriculture. *Production et Consommation des engrais chimiques dans le monde*. 2nd Edition, 1914. (E4.)

Yield of Guano from the different zones.

Year	by the Peruvian Corporation		for the farmers of the country
	Ballestas Islands	Total	
	tons	tons	tons
1909	5 342	23 236	2 708
1910	6 650	24 403	4 109
1911	7 700	22 377	3 168
1912	4 272	16 865	4 176
	23 964	86 881	14 161

of agriculture in Peru with all the guano it requires, as is contemplated by art. 21A of the contract cancelling the external debt of 1894 which granted the right of exportation to the Peruvian Corporation.

1096 - Recent Inoculation Experiments on Virgin Sphagnum-Moor Soils, with Various Cultures of Bacteria of Leguminosae. — VON FEILITZEN and NYSTROM in *Journal für Landwirtschaft*, Vol. 62, Part 3, pp. 282-283. Berlin, October 1, 1904

The writers conducted at the Swedish Moor Experiment Station Jönköping comparative inoculation experiments with inoculated earth with earth cultures of Kühn's Nitragin, with earth cultures of Sime Azotogen, and with Earp-Thomas' American Farmogerm. The experiments were carried out in a greenhouse in unglazed stoneware pots, each of which was filled with 33 lbs. of virgin undecomposed sphagnum peat fresh from the pit, all precautions having been taken to prevent a infection by contact.

For every special inoculation, five parallel pots had been prepared and manured at the rate of 4460 lbs. of slaked lime, 357 lbs. of superphosphate, and 357 lbs. of 38 per cent. potash salts per acre.

The plants grown were yellow lupins. The seeds were sterilized by being steeped for 5 minutes in 90 per cent. alcohol and then dried aseptically. The lupins developed quite normally and yielded the following amounts of green stuff per pot:

Not inoculated	347	gram
Inoculated with inoculated soil	541	"
" " Nitragin	583	"
" " Azotogen	601	"

The effect of inoculation was thus very marked, and the yield of lupins was nearly doubled. On the average, Azotogen gave the best, while Farmogerm gave the smallest results. The difference between the first three substances was so small, that considering also the differences in the parallel pots, it is not possible at present to give the preference to one rather than to another.

The examination of the roots showed that Farmogerm had caused much less abundant formation of nodules than the other substances employed.

97 - **The Consumption of Fertilisers in South China.** — CARLETON, A. E. (Vice Consul General, Hongkong), in *Daily Consular and Trade Reports*, Year 17, No. 214, p. 1404. Washington, September 1914.

The consumption of manures, both natural and chemical, in China is not materially increased in the last few years, but the prospects are rather in favour of an improvement for the future. A large amount of money has been spent already in demonstrating the advantages to be derived from the use of proper manures, and many farmers in the delta of Canton and elsewhere have been supplied with fertilisers free of charge in order that they might see for themselves the efficacy of modern methods.

A considerable trade in bird manure has developed in Canton and the neighbourhood, and it is estimated at about \$175 000 per annum. This class of manure is sold at about \$1.75 per picul of 133 $\frac{1}{3}$ pounds.

A considerable amount of natural manure is exported to China from Macao (Portuguese Colony), the total trade in 1912 being over \$80 000. To these manures must be added a certain per cent of bean cake which comes from North China. The trade of Chilean nitrate of soda is on the increase, although the total imports into Hongkong amounted last year to only about 500 tons. This manure costs c. i. f. Hongkong about \$50 per ton. This high price has restricted its use to market gardening purposes and for manuring mulberry trees. The Chinese Government treats nitrate of soda as dangerous goods like gunpowder and it is necessary to obtain a permit from the central government for its importation.

The duty on nitrate is about \$0.17 per 100 lbs. Sulphate of ammonia comes chiefly from England and Germany, and the importations amount to about 1500 tons per year; the c. i. f. price Hongkong is about \$4.25 per ton. This fertiliser is used mostly for rice but in a very small way, as the price is prohibitive for the Chinese farmers. A very little guano is imported from islands in the Pacific. It is said that a Chinese company intends to work the deposits in Pratas Islands. Most of the phosphate output from Christmas Island goes to Australia and that of Ocean Island to Japan.

The total value of manures, including chemical manures, imported to China during 1912, was \$503 205 and in 1913 \$700 872 (1).

98 - **Fractional Analysis of Wheat.** — BARBIERI, N. A., in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 7, pp. 431-434. Paris, August 17, 1914.

By the successive action of various neutral solvents on 44 lbs. of wheat (*T. turgidum*) ten distinct fractions including the ash were obtained.

1st Fraction: Washing with distilled water; the slightly coloured solution is concentrated on a water bath after filtration; on treatment with chloroform the mixture separates into two layers, an aqueous solution above and a chloroformed solution below.

AGRICULTURE
BOTANY.
CHEMISTRY
AND
PHYSIOLOGY
OF PLANTS

(1) See: *The International Movement of Fertilizers*. B. Sept. 1914.

(Ed.).

2nd *Fraction: Maceration.* — The washed grains remain for 15 hours in chloroformed distilled water; they are then stirred and filtered. The highly coloured solution, is concentrated on a water bath and treated with chloroform, when it separates into two layers as above.

3rd *Fraction: Extraction with hot water* (at 50°-60° C.) so as to soften the completely macerated grains, without breaking the periderm. The solution is concentrated on a water-bath and precipitated by means of strong alcohol, the precipitate being separated by filtration.

4th *Fraction: Extraction with boiling water.* — The softened grains are boiled for one hour, causing them to swell and break. The liquid is then filtered through a porcelain filter, concentrated on a water bath and precipitated by means of strong alcohol, the precipitate being separated by filtration.

5th *Fraction: Sifting.* — The swollen grains are sifted and treated with strong alcohol, which dehydrates and disintegrates them into a white homogeneous finely granular mass, which has the appearance of a meal without bran, obtained by coagulation with alcohol without mechanical means. This meal is separated from the alcoholic liquor by filtration.

6th *Fraction: Pericarps and germs.* — The two epidermal layers and the germ remaining behind on the sieve are extracted with strong alcohol and filtered.

7th *Fraction: Chloroformed solution.* — The preceding solutions in water and alcohol are mixed and distilled until free from alcohol. The residue aqueous solution is concentrated on a water-bath, filtered and treated with chloroform. The two layers thus formed are separated by decantation. The lower chloroform solution is mixed with the preceding chloroform solutions and distilled. The residue is extracted with ether, the solution filtered and the ether distilled. The residue is then extracted with absolute alcohol, the solution is filtered and evaporated in vacuo to dryness leaving about 2 gm. of a yellow colouring matter known provisionally as *bleine*, which is probably a physiological transformation product of chlorophyll. It does not give the biuret and acrolein reactions, is insoluble in water, but soluble in benzene, carbon disulphide, petroleum ether, etc.

Alcohol is added to the aqueous solution until a slight cloudiness appears. It is then dialysed and the dialysed liquid is concentrated on a water-bath. On the addition of excess of acetone, two salts, monopotassium phosphate and potassium sulphate, are precipitated and purified by dialysis and reprecipitations.

These salts have been obtained by extraction from wheat grown on land which has not received mineral manures for a considerable time. Analysis of the dialysed salts shows the absence of chlorides and monocalcium phosphate.

8th *Fraction: Ethereal solution.* — The flour, seed-coats and germs, and the first two precipitates free from alcohol, are extracted with ether. The ethereal solutions are filtered together and distilled, leaving 225 gm. of an oily residue, which, when treated with acetone, is separated into two parts, one soluble, the other insoluble; they are separated by decantation.

insoluble portion consists of 211 gms. of an oil insoluble in alcohol and from phosphorus, sulphur, nitrogen and ash, and 6gms. of stearin. The one-soluble portion contains traces of bleine, palmitin, and oleopalmitin, traces of phosphates that can be separated by dialysis with ether.

The fact that the total phosphorus of a complete ethereal extract of it is found only among the products of treatment with acetone and that supposed lecithins are insoluble in acetone, would appear to prove the presence of lecithin from wheat, as previously stated by the writer (*Comptes-rendus*, 1st August 1910).

9th and 10th Fractions: Insoluble ash. - 1 kilogram of the flour from the extraction is well dried and incinerated with 1 kilogram of seed-coats germs. This ash contains the insoluble salts of the flour, 0.30 per cent, the insoluble salts of the pericarp and germs, 0.62 per cent. They consist chiefly of calcium sulphate and tri-calcium phosphate. Carbonates entirely absent.

Former determinations of the mineral matter of plants were entirely based on studies of the ash. The amounts of acids and bases were determined and the salts were estimated by calculations from these figures without recognising the many changes induced by the high temperatures during germination. By means of the methods described above all the soluble salts can be separated by dialysis and the insoluble ones, which probably at high temperatures do not affect, by incineration.

- **Studies on the Mulberry Leaf.** - I. Chemical composition of mulberry leaves attacked by *Diaspis* and of healthy leaves. - II. Chemical composition of mulberry leaves in the morning and evening. PRIGORINI, L., in *L'Italia Sericola*, Year I, No. 5, pp. 1-3; No. 6, pp. 11-12. Milan, September and October 1914.

1. No extensive and systematic researches have been hitherto undertaken with the object of establishing the relation between the chemical composition of mulberry leaves and yield of silkworms. It is generally admitted that the chemical composition of the leaf has considerable effect on the quality of the silk, and according to ABDERHALDEN and DEAN the amino-acids are of most importance in this connection.

The leaves chosen for the experiments by Prof. VERNON were very severely damaged by *Diaspis*. Control leaves were taken from trees of the same age but free from the disease owing to severe pruning and the absence of *Prospaltella berlesei*. It should be noted that the leaves were collected in the beginning of June at 8 a. m. during dull weather, seeing that leaves are much richer in substance at the end of the day after exposure to sunshine.

The 200 diseased leaves subjected to analysis weighed, without petioles, 38 gms. while the 200 healthy control leaves weighed 205.6 gms. The results of the analysis are shown in the following table:

Table I. — *Composition of the leaves.*

	Healthy trees per cent	Diseased trees per cent
Water	73.4	68.6
Dry matter at 100° C.	26.6	31.4

100 parts of dry matter at 100° C. contain :

Ethereal extract	3.41	3.87
Crude fibre	12.78	11.34
Ash	12.70	10.54
Total nitrogen	4.19	3.05
Proteid nitrogen	3.78	3.04
Non-proteid nitrogen	0.41	0.46
Percentage of non-proteid nitrogen in total nitrogen	9.78	13.17

100 parts of the fresh leaves contain :

Water	73.4	61.6
Dry matter at 100 °C.	26.0	31.4
Ethereal extract	0.9	1.2
Crude fibre	3.4	3.56
Ash	3.37	3.30
Total nitrogen	1.11	1.09
Proteid nitrogen	1.005	0.954
Non-proteid nitrogen	0.109	0.144
Percentage of non proteid nitrogen . .	9.82	13.21

No general conclusion can be drawn from this analysis as to the greater or less value of the diseased mulberry leaves, since no account has been taken of the amounts of sugar, starch and other substances such as pentosans which can be utilised by the silk worms to a greater or less extent. The following conclusions however may be drawn :

- 1) The leaves attacked by the *Diaspis* become thicker, tougher almost coriaceous and seem therefore less digestible than healthy leaves.
- 2) The low percentage of water is not conducive to their easy digestion and assimilation.
- 3) The total nitrogen and protein of the dry matter is considerably less in the diseased leaves.
- 4) The percentage of fatty matter, on the contrary, is increased.
- 5) crude fibre is more abundant in the fresh leaves of the diseased plants.

Thus, healthy mulberry leaves have a greater food value than the diseased, though the differences may not be sufficiently great to justify the rejection of diseased leaves as food for rearing silkworms.

II. — For these experiments leaves were collected on land below the Royal Silkworm Station of Padua, at sunset after five days during which the leaves had had good exposure to sunlight, and at daybreak

TABLE II. — Chemical composition of mulberry leaves of the variety *Limoncina* collected during the first days of September,

	Morning		Evening	
	Percentage of dry matter	Percentage of fresh matter	Percentage of dry matter	Percentage of fresh matter
Water	—	68.419	—	63.156
Matter at 100° C.	—	31.581	—	34.844
Etheral extract	5.521	1.743	5.443	1.880
Nitrogen	2.445	0.772	2.534	0.883
Proteid nitrogen	2.309	0.729	2.368	0.824
Non-proteid nitrogen	0.1105	0.043	0.166	0.059
Saccharides calculated				
Glucose	7.326	2.313	8.064	2.810

These results support the following conclusions :

1. The analysis of the leaf distinctly shows the characteristics of autumn leaves. The percentage of water is less and the percentage of dry matter greater than during the spring and summer, as seen from KELLNER'S analyses and results obtained by the writer on the leaves of healthy mulberries at the beginning of June. The greater quantity of substances extracted by ether (fat) is in agreement with the results of SCHULZE and SCHÜTZ concerning the leaves of *Acer Negundo* (Die Stoffwandlungen in den Laubblättern des Baumes insbesondere in ihren Beziehungen zum herbstlichen Abfall, *Landw. Versuchs-Stationen*, XXI, 313, 1909). In these analyses the etheral extract of the dry matter was 4.87 per cent one evening during the day and reached 10.86 per cent on the evening of September 6. The decrease in total nitrogen, proteid nitrogen and non-proteid nitrogen of the autumn leaves compared with spring and summer leaves is very apparent and agrees entirely with the results of KELLNER'S analysis, as well as with those of SCHULZE and SCHÜTZ.
 2. As in the case of other plants, mulberry leaves during the day under the action of sunlight increase their quantity of organic matter, including both carbonous and nitrogenous matter, both proteid and non-proteid, as well as carbohydrates. These results are fully confirmed by those of SCHULZE and SCHÜTZ for the leaves of *Acer Negundo*.
 3. Leaves collected at sunset contain more food material than leaves collected in the morning.
- It is reasonable to suppose that these differences will be still greater during the spring and summer.

1100 - **Methods of Estimating Carbohydrates. II. The Estimation of Starch in Plant Material** (1) — DAVIS, W. A., and DAISH, A. J. (Rothamsted Experimental Station) in *The Journal of Agricultural Science*, Vol. VI, Part. 2, pp. 152-168. Camb. May 1914.

The writers summarise their conclusions as follows :

" 1. The Sachsse method of estimating starch is unreliable in case of plant material ; not only does the presence of pentosans falsify results, as pentoses are formed during the hydrolysis, but actual destruction of dextrose occurs during prolonged treatment with dilute acid.

" 2. O' Sullivan's method gives low results owing to the loss of dextrose which occurs during the purification of the solution after the conversion by diastase.

" 3. A method is described for estimating starch based on the use of takadiastase ; under suitable conditions this converts the starch into maltose and dextrose only, and no loss of these sugars occurs when the solution is treated with clearing agents such as basic lead acetate.

" 4. The necessity of removing substances soluble in water, such as gums, etc., which are optically active and thus cause error in the estimation of starch in plant material is emphasised. Special care is necessary in sampling".

1101 - **The Estimation of Hydrocyanic Acid in Feeding-Stuffs and its Occurrence in Millet and Guinea Corn.** — FURLONG, J. R., in *The Analyst*, Vol. XX No. 463, pp. 430-432. London, October 1914.

A new method of estimating hydrocyanic acid in feeding-stuffs is described ; it consists essentially in the conversion of hydrocyanic acid into Prussian blue and in the comparison of the resulting coloration with standards ; it avoids the disturbing influence of hydrolytic and distilla-

Plant	Stage of growth	Hydrocyanic acid per 100 g.
Guinea corn	6 in. high	0.004
	12 " "	0.01
	18 " "	0.009
	24 " "	0.0025
	8 ft. full grown but unripe	—
	8 ft. full grown and ripe	—
Millet	6 in. high	0.006
	12 " "	0.018
	18 " "	0.022
	24 " "	0.045
	8 ft. 6 in. high	—
	11 ft. 6 " "	—

(1) See also No. 22, B. Jan. 1914.

acts which accompany the hydrocyanic acid in the usual iodine or nitrate titration methods.

Millet and guinea corn (*Panicum maximum*) plants from Northern India were recently examined for hydrocyanic acid by the above method. Results are shown in the Table on the opposite page.

All the young plants contained a cyanogenetic glucoside, the amount increased increasing up to a certain point in the life-history of the plant then diminishing, so that the full-grown plants were free from such substances. The results indicate the probable course of the development and disappearance of the cyanogenetic glucosides in millet and guinea corn, but no general conclusions can be drawn until a larger number of analyses have been investigated.

Some Accessory Factors in Plant Growth and Nutrition. — BOTTOMLEY, W. B. (King's College, London) in *Proceedings of the Royal Society*, Vol. 88, No. B 602, pp. 237-247. London, September 15, 1914.

During the summer of 1913, a number of experiments were made at the Royal Gardens, Kew, (1) on a series of plants to test the manurial value of Sphagnum peat which had been incubated with a mixed culture of aerobic soil organisms for a fortnight at a temperature of 26° C. It was then discovered that by this bacterical treatment the humic acid in the peat is converted into soluble humates, and this bacterised peat, after irrigation, forms an excellent medium for the growth and distribution of nitrogen fixing organisms. As the experiments progressed it was evident that, in addition to the ordinary plant food constituents, there was present in the bacterised peat a substance which stimulated growth in a remarkable manner. Further experiments showed that this substance was soluble in water, and was effective in very small quantities. It was found that seedlings of *Primula malacoides* potted up in loam, leaf-mould, and, and treated twice with a water extract of only 0.18 gm. of bacterised peat, were, after six weeks' growth, double the size of similar untreated plants, and it was noted that flower production and root development were promoted equally with increase of foliage.

These results suggested that the growth stimulating action of the bacterised peat might be due to the presence of a substance or substances in nature to certain accessory food bodies known to play an important part in animal nutrition. The latter are also known to be soluble in water and alcohol, so the bacterised peat was extracted with absolute alcohol, the extract was evaporated to dryness, and taken up with warm distilled water, portions of 100 cc., containing the extract from 1 gm. of peat, being placed in each of 12 flasks. Six of these were boiled for 15 minutes and all, including six other flasks, containing only distilled water, received 0.2 gm. of potassium phosphate ($K_2 H PO_4$), 0.02 gm. of magnesium sulphate and 0.2 gm. of calcium carbonate, and were inoculated with 1 cc. of a uniform suspension of *Azotobacter chroococcum*. The contents of two flasks from each of the three series of six were analysed

at once to serve as controls while the remaining four of each series incubated for eight days at 26° C., at the end of which period they analysed by the Kjeldhal process for their nitrogen content. The are given in Table I.

TABLE I.

Series	Nitrogen content	
	mgm.	mg
I. Complete food	1 Control	0.4
	2 "	0.4
	3 Culture	4.6
	4 "	4.4
	5 "	3.6
	6 "	4.4
II. Complete food + alcoholic extract of bacterised peat	1 Control	2.6
	2 "	2.3
	3 Culture	20.7
	4 "	20.5
	5 "	19.9
	6 "	20.9
III. Complete food + boiled alcoholic extract of bacterised peat.	1 Control	2.3
	2 "	2.5
	3 Culture	19.6
	4 "	19.0
	5 "	20.6
	6 "	19.4

The results indicate clearly that there is present in the bacterised a substance which stimulates plant growth and which is of fairly nature, as almost equally good results were obtained with the boiled with the unboiled extract.

In order to test whether the active substance is present as such original peat, or whether it is produced in the bacterised peat as a of treatment, an extract of the raw peat was made in precisely the manner as described for the bacterised peat and incubated as before increased growth was apparent in the cultures containing alcoholic of raw peat.

The active substance being evidently produced in the bacterised as a result of treatment, and since this treatment consists essentially production of soluble humates by bacterical action, a test was made ascertain whether the chemical production of soluble humates was

ly effective. Two equal portions of raw peat were saturated with ones containing 1 per cent. of their weight of sodium carbonate, and stirred at frequent intervals for several hours. One portion was dried slowly at room temperature and an alcoholic extract taken therefrom; the other portion was leached with water until the washings were colourless, the water extract was then evaporated to dryness and the residue thus obtained extracted with alcohol. The effect of both the alcoholic and water extracts was tested with *Azotobacter* and again the cultures failed to reveal any stimulation of the organism.

The accessory bodies concerned in animal nutrition have been shown to be precipitated by phosphotungstic acid; the alcohol extract of the bacterised peat was therefore treated with phosphotungstic acid and a fractionation made which was used in solution in the proportion of 17 parts per million. This fraction was tested upon wheat seedlings: ten seeds were sown in clean sand in each of nine pots which were arranged in three groups of three pots each. Series I was treated with a complete food solution (containing nitrogen, phosphorus and potash estimated as N H_4 , and K_2O in the proportion of 400, 200 and 1220 parts per million respectively). Series II was treated with complete food plus alcoholic extract from 10 gms. of peat per litre of solution, and Series III with complete food plus phosphotungstic fraction from 10 gms. of peat per litre of solution. Each pot was treated with 100 cc. of its solution one week before sowing the seed and the treatment repeated once a week for five weeks at the end of which period the plants were uprooted, washed, dried and weighed. The results are given in Table II. —

TABLE II.

Series	Weight of 30 plants (green)	Increase over Series I
	gms.	per cent.
Complete food	11.94	—
" + alcoholic extract . . .	14.46	21.1
" + phosphotungstic fraction	15.45	29.4

These results indicate that the stimulative substance in bacterised peat is precipitated by phosphotungstic acid and that this phosphotungstic acid is quite as effective as the original alcoholic extract. In order to gain working by analogy with the accessory bodies concerned, in animal nutrition a further fractionation was carried out with silver nitrate. The alcoholic solution contained 0.35 part per million of the dry silver fraction and was also tested concurrently with the phosphotungstic fraction upon wheat seedlings as before. The results are given in Table III.

TABLE III.

Series	Green weight 45 plants	Increase over Series I	Dry weight at 100° C.	Loss on Sea
	gms.	per cent.	gms.	per
I. Complete food	64.5	—	13.3	
II. " " + phosphotungstic fraction	96.8	50.0	16.4	2
III. " " + silver " "	91.5	49.6	15.7	1

The silver fraction having thus given results approaching the photungstic fraction its effect was next tested on wheat seedlings in a culture. At first the growth of the test and control plants was approximately equal, but after the first fortnight the seedlings in the control set seemed unable to utilize the food elements supplied to them, those in the silver fraction series went on growing up to the end of experiment (50 days).

It has previously been shown that seeds of barley, oats, peas, flax fed to guinea pigs, contained no accessory bodies having a curative effect on scurvy, but that these were developed during germination. The facts indicating the possibility of the development during germination of special growth substances which enable the embryo to utilize the material present in the seed, a further series of water cultures was carried out in which the wheat seedlings were carefully separated from their parents as soon as possible after germination. The difference in growth between the control and silver fraction set was even more marked than in the previous experiment as the control set never increased more than 5 per cent of its original weight, while at the end of the experiment the silver fraction set had increased 59 per cent. of its original weight.

It would therefore appear that during the germination of wheat certain substances are formed which enable the young embryo to utilize the food material's present. The supply of these substances formed in the seed during germination is sufficient to establish the embryo as an independent seedling, then some other source is necessary. It has been shown that these accessory food substances are produced when peat (decayed vegetable matter) is acted upon by certain soil bacteria, and by natural inference is that during the bacterical decomposition of organic matter in the soil, that is during humus formation, these substances are formed, hence the beneficial effect of farmyard and other organic manures. The specific action of these accessory substances is not known and experiments are in progress to test various hypotheses in connection.

PLANT
BREEDING

1103 - Lax- and Dense-Eared Wheats. — PARKER, W. H., in *The Journal of Agricultural Science*, Vol. VI, Part 3, pp. 371-386. Cambridge, September 1914.

The crosses which are here described were made in 1909 by Prof. Biffen, with the object of continuing his investigations on inheritance.

ptibility and immunity to attacks of *Puccinia glumarum*. The material, however, displayed so much diversity in the density of the ears that it was ultimately used only for investigating the mode of inheritance of this character.

With regard to preceding investigations, it should be noted that SPILLSTRAMPELLI and v. RÜMKER all get an F_1 of intermediate character, in F_2 of 1 dense : 2 intermediate : 1 lax; while WILSON and TSCHERINDENSENSE are distinctly dominant in F_1 , and the former got a ratio of 1 dense : 1 lax in F_2 . NILSSON-EHLE and BIFFEN obtained different results from different crosses.

In the present investigation, two crosses were utilized: American Club \times Square White and American Club \times Square Ghurka.

American Club is a typical *compactum* wheat, while Square White and Square Ghurka are both *vulgare* wheats of hybrid origin which had bred true to type for a series of years.

In *compactum* wheats the average space between the spikelets of the ear, in millimeters, or the density, is 2.1 or 2.2 while in *polonicum*, which is typical of the lax ear, it is 6.6. Between these two extremes there is an almost unbroken series among the *vulgare* wheats: the inter-spikelet length of Square Ghurka varies from 3.9 to 5.1 and that of Square White is practically the same; they would thus both be considered lax wheats. NILSSON-EHLE, whereas American Club is a typical *compactum* wheat with an average length from 1.9 to 2.5.

The F_1 generation of American Club \times Square Ghurka was apparently almost intermediate, but the tendency was toward the dense side.

The F_2 showed, besides all intermediate forms, a large number of plants the ears of which were either more lax or more dense than the ears of either parent. Their curve, though continuous, gives evidence that segregation is taking place. Offspring was grown from each plant of F_2 ; in F_3 nearly all the lax-eared plants bred true to laxness and a certain proportion of the dense-eared plants bred true to denseness, but it was practically impossible to see which plants bred true to their particular degree of denseness. It is particularly noticeable that although a large proportion of very dense-eared plants threw no lax, there were several which were lax, and that the curves which the F_3 series form have shifted toward the lax side.

Similar results were obtained in the F_2 and F_3 of the Square White \times American Club cross.

From the Square Ghurka American Club cross, 36 F_3 plants were selected, being chiefly selected either because they lay between the two extremes of the curve or because they lay at the extremes of the curve. In the partial F_4 (1913), the peaks revert almost exactly to the positions which they held in 1911, and this seems to suggest that some such factor as the wetness of the summer of 1912 was responsible for the shift in the curves for that year.

A fact which is noticeable in the descendants of the F_2 and F_3 plants is that in the non-splitting dense and lax, especially in the former, there seems to be a distinct correlation between the degree of density of the parent and the average degree of density of the offspring. There can be two possible theories to explain this phenomenon. It may be due to nutrition, admitting that the grain of the very compact ears is lighter than that from ordinary ears, that weak plants develop from small grain and the ears of weak plants are appreciably more dense than those of non-weak plants. But this theory is not very probable (see the works of JOHANNSEN and others). It seems safe therefore to conclude that the alternative theory is the true one, namely, that underlying the main 3:1 ratio, there are other factors which have a modifying effect on the laxness or denseness of the ear. This is probably also the explanation of the appearance of plants which exceed the limits of either parent.

From the comparison of the number of nodes and the rachis length of the ears of lax, dense and Squareheads Master wheat of 1912 (wet) and of 1913 (relatively dry), it appears that the first number in 1913 was greater respectively by 33, 39 and 10 per cent, and the second was respectively greater by 15 and 21 per cent and smaller (Squareheads Master) by 2 per cent. Consequently, the larger variation is a meristic variation and external conditions would seem to cause an alteration of nearly 10 per cent in the number of parts. As the nodes are already completely formed in young wheat plants, the conditions which control this variation can only be operative during the early life of the plant, while those which control the length of the rachis act during the whole growing period of the plant. Thus weather experienced after the earlier period of growth might nullify the effect caused by the weather of that time, and the variation of the two characters would become practically independent.

From the above it will be seen that the actual method of classifying wheats according to the density of their ears is unreliable, as the number of internodes and the total rachis length vary largely from season to season and it might be possible to get a variability of well over 50 per cent in a variety from one year to another, and that even when grown on the same soil with identical manurial and cultural conditions.

1104 - On the Emasculation of Giant Maize in Serbia. — HECKEL, EDOLPH. *Comptes Rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. 159, pp. 595-597. Paris, October 1914.

Previous work (1) by the writer has shown that the giant maize of Serbia (13 feet in length of stems and 8 inches in length of ear), which normally contains about 9 per cent of saccharine matter in its sap at the beginning of September, has its sugar content increased to a maximum of 12 per cent by partial removal of the male flowers and to 11.57 per cent by removal of the female flowers. After the end of September the amount of sugar rapidly diminishes and at the period of harvest it is less than 10 per cent.

Later experiments with plants grown close together under identical conditions have shown that the same results can be obtained.

itions have shown that the effect of emasculation on the sugar content of sap is very variable and may even be negative. With the formation of reserve of sugar there is also a formation of starch reserves, except the sugar content remains low after removal of the male flowers or the flowers are left intact.

The writer proposes to increase and to fix the sugar content by means of selection. Partial emasculation does not affect the yield of grain and is easy to carry out; it also provides a good winter forage much liked by stock.

— **Alfalfa Hybridization.** — SOUTHWORTH, WILLIAM (Department of Plant Breeding, Ontario Agricultural College, Guelph, Canada) in *The Journal of Heredity*, Vol. V, No. 10, pp. 448-457 + 3 figs. Washington, October 1914.

Notwithstanding the immense economic value of the present day strains of alfalfa grown in the United States they may still be improved in at least two lines:

1. To obtain a strain having the capacity to seed more freely under various environmental conditions.

2. To obtain a variety which will be better adapted for grazing. The first part of the problem might be solved by simple selection; unfortunately all the types which offer possibilities for grazing appear to be below the average in the production of seed. The writer therefore endeavoured to solve the problem by crossing with black medick (*Medicago lupulina* L.), which yields good grazing but not good hay. In the United States it is looked upon as a weed.

At the Ontario Agricultural College at Guelph experiments were commenced with the aim of breeding better strains of alfalfa. It was found necessary to arrange a preliminary series of experiments in order to elucidate the complex and still unsettled problem of the pollination of alfalfa flowers. The results obtained showed: 1) that alfalfa flowers are capable of becoming fertilized when insects do not gain access to the stamens (1); 2) that if the stamens and pistil be liberated artificially the flower is capable of producing seeds; hence it is not self-sterile; that bees are the most numerous visitants, but they have the power to extract the nectar from the flower without causing pollination; that a bumble bee is fairly active in fertilizing the flowers; a species of *Andrena* apparently very useful, too; but the most effective of all was found to be a wild bee belonging to the *Megachile* group, as it will pollinate from one to twelve flowers a minute.

DARWIN and BURKHILL had observed, and the writer has confirmed by observation, that the flowers of *Medicago lupulina* are autogamous and produce seed even without the aid of insects. Burkhill found that when these flowers were left exposed to the visits of insects 95 per cent. produced seed; when enclosed in a net 75 per cent. set seed. In practice

(1) The results obtained by PIPER and his collaborators show that in sufficiently favourable conditions of temperature and dryness of the atmosphere, alfalfa produces seed spontaneously also (by automatic pollination) without the assistance of insects. See *ibid.*, B. Oct. 1914.

M. lupulina produces abundant seed under any condition of climate and soil.

The writer commenced the work in 1911. The F_1 generation (plants) showed considerable variations, even among individuals produced from different seeds out of the same pod, and for the most part the plants differed considerably from both parents. Their height ranged from 2 to 23 inches; the stem in some was thin and flexible, in others rigid, and leaves varied from few and small to many and densely crowded.

The second generation was obtained from a plant distinguished by its vigour and abundance of flowers and seeds. The plants composed it showed all the degrees between Talls and Dwarfs, ranging in height from 2 to 11 inches, 78 plants being above the height considered as medium, namely 5.5 inches, and 30 below it, which would give the ratio of Talls to Dwarfs as 2.6 to 1 instead of the calculated Mendelian ratio of 3:1. For the habit of growth, 88 plants were non-erect (3 prostrate and 85 decumbent) and 20 erect (12 semi-erect and 8 erect), which gives the ratio of 4.4 non-erect to 1 erect, instead of 3:1.

The experiments are being continued. In the course of these the writer observed that those seeds which remained hard and dormant after having been for several days in the germinator at 70° F., sprouted in one or two days, when replaced in the germinator after immersion for 10 minutes in strong commercial sulphuric acid and subsequent wash free from acid. The few seeds which resisted this treatment were treated to a second immersion in sulphuric acid, after which they sprouted.

1106 — **Tree Growth and Seed.** — BERRY, JAMES B. (Department of Forestry, Pennsylvania School of Agriculture, State College, Pa.) in *The Journal of Heredity*, Vol. 4, No. 10, pp. 431-434 + 2 figs. Washington, October, 1914.

Dr. ARNOLD ENGLER (1), at the Forest Experiment Station of Zürich has a number of investigations in course, which illustrate the inheritance by seedlings of the main characteristics of the parent tree. In one of his experiments two plots are occupied by spruce seedlings varying in height from 3 to 10 feet. The seedlings on Plot I show more than 50 per cent crooked and twisted plants, while Plot II contains less than 5 per cent of this material. The seed used on Plot I was collected from a gnarled, twisted mother tree, yet not an extreme form. The seed used in Plot II was taken from a mother tree of normal form grown under the same conditions as the deformed one.

A second experiment occupies two adjacent plots, both supporting growth of spruce seedlings about 15 years of age planted at the same distances from each other. The seedlings on Plot I, while entirely less and vigorous, are rounded in form, very dense in character and with branches uniformly small; their height ranges from 12 to 30 inches and they are as broad as they are high. The seedlings on Plot II are entirely normal in form and growth; they are between 3 and 6 ft. in height. The seed on Plot I were taken from a mother tree which was characterized by dense

(1) Influence of Source of Seed. — *Journal of Heredity*, Vol. V, No. 4, p. 185, April, 1915.

arching and slow growth, while, those of Plot II were from a normal tree grown on the same quality site and under similar conditions.

A third investigation deals with the effect of temperature in its relation to transmitted characteristics. Seed was collected from regions of mean temperature varying by 10° F, from that of Zürich to Northern Sweden, altitude and latitude both forming a basis for computation. Two or three rows were planted from each lot of seed, the arrangement being in similar order from the lowest to the highest mean temperature. At present, eight years after the inauguration of the experiment, there results a "terrace" like formation, the relative height growth varying directly with the mean temperature. Further, the plants resulting from seed from a locality of high mean temperature are the first to show active growth in the spring, having a longer growing season, their annual increment is greater and their form is less dense. It is thus very important for the forester to know the origin of the seeds and the quality of the mother plants.

These facts may afford an explanation for some of the unsatisfactory results in forestry. For instance it is said that Scots Pine (*Pinus sylvestris*) gives very poor results in the United States and that it is not adapted to that country. The writer suggests that better results might be obtained by choosing the seed better.

The seedling resulting from seed from a region of higher mean temperature than that of the locality in which it is to grow will preserve its original slim bearing and the long willowy previous year's growth is easily pulled or broken by the weight of the snow. The seed should be chosen from localities having an average altitude and temperature similar to that of the place where it is to be sown, and lastly when regeneration of the forest is to be obtained by spontaneous seeding, the best plants should be selected for this purpose and not the deformed and the cripples, as is too frequently done at present.

The Controlling Influence of Carbon Dioxide in the Maturation, Dormancy and Germination of Seeds. — KIDD, FRANKLIN (Fellow of St John's College, Cambridge) in *Proceedings of the Royal Society, Series B*, Vol. 27, No. 5 B, 597 and 599, Biological Sciences, pp. 408-422 and 609-625. London, June 1914.

The object of this research is to solve the problem of the non-germinating of maturing seeds while still upon the parent plant and the large number of cases of delayed germination or non-germination of shed seeds which to all appearances are in good condition for germinating.

The dormancy of moist seeds must be due either to the absence of an essential stimulus or to the presence of an inhibitory agent. CROCKER found that *Xanthium* seeds would not germinate at a temperature of 10° C. though provided with a sufficient supply of water and a normal atmosphere with a partial pressure of oxygen equal to 150 mm. On removal of the testa, however, germination immediately took place. SHULL found that these seeds will germinate at a temperature of 21° C. with a minimal oxygen pressure of 12 mm. when the seed coat is removed, thus showing that the wet testa is able to reduce the partial pressure of oxygen in its passage through it, from 150 mm. pressure to less than 12 mm.

It is possible that the absence of germination during the maturation of the seed and later during its normal resting period may be due not only to an insufficient oxygen stimulus but also to some inhibitory cause, such as a relative rise in the actual carbon dioxide pressure in the embryo tissues.

Experiments were conducted with various seeds in atmospheres with various partial pressures of carbon dioxide. It was found that increase in carbon dioxide pressure retarded germination and that this retardation was not accompanied by injury. The seeds used in these experiments fell into two classes: 1) those which germinated at once after removal from the inhibitory doses of carbon dioxide (beans, cabbage, barley, peonions); 2) those in which the retardation continued indefinitely after removal from the carbon dioxide (*Brassica alba*) and was terminated only by complete drying and re-wetting, or by the removal of the testa.

This suggests that carbon dioxide lowers the degree of permeability of the testa in the second class of seeds, thus causing a reduction in the amount of oxygen reaching the embryo and a relative rise in the actual carbon dioxide pressure in the embryo tissues. The condition of prolonged inhibition after removal to air produced in *Brassica alba* is strikingly suggestive of the condition of seeds often met with in nature, the germination of which is delayed in spite of suitable conditions of temperature and water. Similar results were obtained with *Brassica alba* seeds in the soil under natural conditions by carbon dioxide arising from decaying vegetable matter. The high carbon dioxide content of the soil was found to continue for a considerable period (7 months). It would therefore appear that caution is necessary in sowing seed in ground in which green crops or it has been recently ploughed in.

A further series of experiments was carried out to determine the relation of the retarding effect of carbon dioxide to temperature and oxygen supply. It was found that low temperatures and low oxygen supply both increased the inhibitory effect of given partial pressures of carbon dioxide and inversely a rise of temperature or rise of the partial pressure of oxygen diminished the inhibitory value of the given carbon dioxide pressure.

The growth of the embryo of a seed proceeds continuously after fertilisation and up to a certain point resembles in some respects the subsequent growth on germination. Beyond this stage partial inhibition begins to increase in the case of most seeds until, at the stage of complete maturation, growth is arrested or suspended. Experiments were conducted to ascertain the nature of this inhibiting factor. It was found that removal of the testa in the case of peas greatly increased the rate of germination, and that beans germinated after complete air drying in the laboratory, at the moment sprouting actually contain less water than when originally removed from the fresh green pods. It would appear therefore that neither lack of water nor any physiological insufficiency can be regarded as the factor limiting germination.

The carbon dioxide content of maturing and germinating seeds was then determined by grinding with baryta and titration with hydrochloric

It was found that the carbon dioxide content of maturing seeds is considerably greater than that of germinating seeds in the case of corn and beans.

In the case of seeds with a low carbon dioxide content, the writer confirmed the conclusions of DRABBLE and LAKE that small quantities of carbon dioxide have a stimulating effect on germination. It would appear therefore that the effect of larger percentages of carbon dioxide is not of a true narcotic and that the results induced by carbon dioxide in resting seeds are a phase of narcosis.

In the case of rapidly deteriorating seeds, such as those of *Hevea brasiliensis*, the carbon dioxide naturally produced by respiration in a closed jar rose to 40 per cent, and the presence of this was found to be accompanied by a marked prolongation of the vitality of the seeds.

The biological importance of the dormancy of moist seeds in relation to the struggle for existence and in evolution is also pointed out.

Studies upon Influences affecting the Protein Content of Wheat (1). — SHAW, J. W., in *University of California Publications in Agricultural Sciences*, Vol. 1, No. 5, p. 63-126. Berkeley, Cal. October, 1913.

In 1905 the Merchants' Exchange of San Francisco, the State Board of Trade, the Sacramento Valley Development Association, and the more important millers and grain dealers of California, called the attention of the Agricultural Department of the University to the low gluten content of the local grown wheat, which necessitated the importation of many thousands of tons of wheat per year to maintain the quality of Californian flour. In 1906 the Department of Agriculture initiated these researches to investigate: 1) the effect of changes of environment upon the growth of wheat, particularly as regards the composition of the wheat kernel and special reference to the causes of the production of a low protein content; 2) to discover or produce such wheat as will yield the largest profit for the farmer, and will supply the millers with wheat of superior quality; 3) to conduct similar experiments with oats, barley, and other cereals as may be desirable; 4) to determine the effectiveness of various methods of culture as affecting the production of cereals.

This publication contains a very detailed account of the results of researches on the variation in the protein content of wheat grown under different conditions as regards: 1) latitude, 2) season, 3) time of planting, 4) time of harvesting, 5) amount of sunshine, 6) irrigation, 7) reduction of night temperatures and 8) the different fertilizers.

Summarising the results of this work carried out over a period of five years the writer draws the following conclusions:

1. There are important seasonal, varietal, and individual variations in wheat plants with respect to protein content.

2. The chief factor causing the most pronounced variation in protein content is climate, particularly the moisture supply in the final stages of

(1) See also No. 228, B. March 1913 and No. 331, B. April 1914.

growth. Wheat grown in the coast States is, as a class, much lower in gluten content than wheat grown in the central-west or the northwest States.

3. The tendency of wheat kernels to change from a glutenous to a starchy condition is not constant, but is mainly dependent upon individuality of the plant and seasonal influences, particularly moist supply in later stages of growth. The use of a perfectly typical gluten seed is invariably followed under Californian conditions by a lowering of the gluten content, as indicated both by the physical appearance of grain and by its protein content.

4. In wheats all of which are entirely starchy there may be reversion to an entirely glutenous condition in a single season, or the reverse may occur, according to the seasonal condition.

5. Allowing the grain to stand on the straw in the field until fully ripe does not materially affect the protein content.

6. The protein content of wheat is affected by the time of seeding; the product of late-seeded grain having a higher percentage of protein than that of early-seeded grain.

7. The protein content of wheat is very largely influenced by the water content of the soil in the later period of its growth, and the effect of either irrigation or rainfall during this period is to lower its protein content.

8. The percentage of sunshine which the grain receives during the period of growth has a somewhat direct bearing upon its protein content, but other seasonal conditions are more important.

9. Retarding the growth through cooling the atmosphere has a tendency to increase the protein content.

10. The quantity of available nitrogen beyond that required to supply normal growth has little, if any, influence upon the protein content.

11. The low gluten content of Californian wheats is not due to soil exhaustion, but rather to the following causes: *a*) the long growing period, *b*) relatively early seeding, *c*) the use of varieties of naturally low gluten content, and *d*) the absence of selection of highly glutenous strains.

1109. — **The Variation of Gluten in Wheat Flour and Grain.** — MARCHADIER GOUJON (Director and Chemist of the "Laboratoire municipal agréé du Mans") *Journal de Pharmacie et de Chimie*, Year 106, Series 7, Vol. X, pp. 191-202, 1 September 1914.

According to BALLAND (1), the decrease in gluten in flour observed in late years, that is to say since roller-mills have been substituted for grist stones, is due not only to a degeneration of the grain, but also to methods of grinding which eliminate the germ and the portions of the grain which are richest in nitrogen, to more complete sifting and to the hydration caused by excessive moistening with a view to facilitating the removal of the bran.

(1) See No. 778, *B. Aug.* 1914.

According to VUAFLART, the decrease is to be attributed to atmospheric action. SCHRIBAUX observes that in 1911 (a hot year) the grain was much drier in gluten than in 1912 (a rainy year) and that glutenous varieties grown near Paris had a lower gluten content. On the other hand the gluten content increases in the case of wheat grown on almost virgin soil, without fertilizer, in the plains of America.

Gluten is a characteristic of wheat flour. It is stated that gliadin and glutenin (which is an oxidised anhydride of the first) are wholly, or partially, transformable into one another. FLEURENT has shown that a flour produces softer dough and more digestible bread, the nearer the composition of the gluten approaches to 75 per cent gliadin and 25 per cent glutenin. A deviation of only 2 per cent from this proportion is sufficient to cause a noticeable difference in the bread.

It has been observed that the addition to wheat flour of only a small quantity of other flours causes a great change in the gluten, and a decrease in the amount which is capable of coagulating. When the amount of the other flour introduced passes beyond certain limits, the gluten no longer coagulates at all. Thus its power of coagulation disappears on the addition of 40 per cent of rye flour (COLLIN), 40 per cent of barley meal, 65 per cent of rice flour, 70 per cent of maize flour. These facts have been proved by experiments made by the writers.

The coagulation of gluten is also prevented or hindered by the addition of powdered minerals, and by wheat starch, which suggests that the result is due simply to physical causes.

If the amount of gliadin be diminished, the quantity of gluten decreases in a parallel manner, and since the smallest variation in the proportion of gliadin to glutenin is sufficient to cause very sensible changes in the bread-making quality of the gluten, in the same way a variation in the total of gliadin + glutenin in the paste brings about very rapidly: first the occlusion of a part of this gluten, and finally the complete loss of its power of coagulation.

As has been said, this abnormal decrease in the coagulable gluten has not been noted in the wheat grain. Further, it has been recorded, that gliadin and glutenin are easily transformed into one another, the slightest influence being sufficient to bring about the change. In germination, the ferments which produce solubility hydrate the glutenin, transforming it into gliadin: the proportion $\frac{\text{glutenin}}{\text{gliadin}} = \frac{1}{3}$ is altered, whence the flour gives a lax dough and the bread made from it rapidly hardens and is indigestible.

By too rapid grinding, the grain becomes heated, this giving rise to the hydration and oxidation of the gliadin to form glutenin.

Keeping damp flour in a warm place in the presence of dry air causes slight oxidation and dehydration of the gliadin and improvement of the product. If, on the other hand, a good flour is kept in a damp warm atmosphere, the glutenin becomes hydrated and is transformed into gliadin and the product deteriorates. Such hydration may also be the effect of

meteoric influence: in fact the wheat of wet seasons always yields inferior flour.

It is well known that when the acidity of flour is above 0.050 per cent the coagulation of the gluten is hindered and its elasticity either lessens or lost. An increase of 0.025 per cent in acidity corresponds to a decrease of 10 per cent in the damp gluten *i. e.*, of a little more than 3 per cent in the dry gluten.

It is logical to admit a similar effect of acidity upon the grain also and it cannot be denied that acids influence the formation of gluten.

Nowadays, and especially during the last twenty years, the soils under wheat in Europe have been dressed with superphosphates, which carry into the soil their acid reaction.

This super-acidity due to strong acids (sulphuric chiefly and hydrofluoric in some cases) must have some effect upon the elaboration of gluten in the grain. In fact species of wheat rich in gluten become softer when cultivated in Beauce and Brie, districts which are highly cultivated and much manured with superphosphates, while the gluten is preserved in wheat grown on the unmanured soils of America.

There are no data at hand to show that the acidity of grain has diminished during the last twenty years, but according to the writers there speak in favour of their hypothesis:

1) On adding rye flour to wheat flour, while the gluten diminishes the acidity increases.

2) Rye flour, which contains no gluten, possesses an acidity 6 times greater than that of wheat flour.

3) Acetic acid oxidises and dehydrates gliadin, and when a wheat flour with the proportion $\frac{\text{glutenin}}{\text{gliadin}} = \frac{1}{3}$ is treated with this acid, a gluten is obtained by evaporation, in which this proportion is equal to one.

In conclusion, the diminution of gluten in native wheats is principally due to the effect of acidity.

1110 - Experiments with Autumn Sown Crops in Ontario, in 1911. — ZAVITZ, C. in *The Agricultural Gazette of Canada*, Vol. I, No. 9, pp. 740-742. Ottawa, Canada, September 1914.

Winter wheats. — About 280 varieties of winter wheat and a large number of selections and crosses have been grown under experiment at the Ontario Agricultural College at Guelph, during the past twenty years. Nearly all the varieties have been carefully tested in each five years, after which the inferior kinds have been discarded and the best which have given the best results have been continued in the experiment. Of the named varieties, the fourteen given in Table I were grown nineteen years. The average yields during this period are shown in the Table. The lowest average yields in the nineteen years were 20.2 bushels in 1912; 28.3 bu. in 1895; 32 bu. in 1908; 34.1 bu. in 1901 and the highest yields have been as follows: 66.7 bushels in 1896; 61.6 bu. in 1902; and 60.5 bu. in 1903. In 1899 and 1901 the results were so poor that no satisfactory returns could be made.

TABLE I. — *Yield per acre of winter wheat, average of 19 years.*

Variety	Tons straw	Bushels grain
erson's Golden Chaff	2.9	51.1
perial Amber	3.2	48.1
ty Cenesee Giant	3.0	46.5
gyptian Amber	3.2	46.4
ty Red Clawson	2.8	46.1
ly	2.7	45.0
mania Red	2.9	44.4
na	3.0	43.9
n Island	2.9	43.3
cky Giant	2.8	43.2
y Red	2.7	43.0
llwell	2.8	41.7
rian	2.8	41.5
erson	2.6	41.5

The varieties of wheat which produced the largest loaves from equal quantities of flour, as it appears from careful tests for bread production carried out at the Bakery Branch of the Chemical Department at the Liph Agricultural College, were as follows: Banatka, Crimean Red, Oslof, Tuscan Island, Tasmania Red, Egyptian Amber, Buda Pesth, Jy, Treadwell, McPherson and Bulgarian.

In 1913 the Agricultural College distributed five varieties of winter wheat to a great number of farmers who wished to test them in various parts of Ontario. The average yields per acre are given in Table II. It is to be seen that Imperial Amber, which occupies the second place in the ratings of the College experiments, is classed first in the cooperative experiments with farmers. Crimean Red, although a rather weak-strawed variety, is a good yielder and produces grain of excellent quality.

TABLE II. — *Average yield per acre of winter wheat in 1913-14, in various parts of Ontario.*

Variety	Tons straw	Bushels grain
perial Amber	1.63	31.7
Crimean Banner	1.40	30.8
Crimean Red	1.34	30.4
Oslof	1.28	28.8
Oslof	1.57	28.3

In the cooperative experiments with the farmers, different fertilizers were applied in the autumn to winter wheat: the average yields of grain per acre for eight years were as follows:

Farmyard manure: 20 tons per acre	30.
Mixed fertilizer: nitrate of soda 53 lb., chloride of potash 53 lb. and superphosphate 107 lb. per acre	25.6
Nitrate of soda: 160 lb. per acre	23.5
Chloride of potash: 160 lb. per acre	22.5
Superphosphate: 320 lb. per acre	21.5
Without manure	18.1

Winter rye. — In each of the past eleven years four varieties of winter rye have been under experiment at the College. The following average results in yield of grain and in weight per bushel have been obtained.

	Bu. per acre	Bushel weight lbs.
Mammoth White	58.3	57.5
Washington	55.2	57.0
Common	53.2	57.0
Thousand Fold	53.0	57.4

1111 — On the Botanical Origin of Cultivated Rices. — CHEVALIER, AUG., and ROSE OLIVIER, in *Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences*, Vol. 159, No. 14, pp. 560-562. Paris, October 5, 1914.

The extensive geographical distribution of cultivated rice and antiquity of its cultivation have prevented botanists from determining whether the numerous varieties are derived from one common type or from several, as well as from discovering precisely in which country they originated.

The wild rices of Asia, except one found in Indochina by one of the writers, are distinct from the cultivated varieties. This exception shows no specific differences from cultivated rices and is probably the original species from which all the varieties of the species *Oryza sativa* have been derived.

Four wild species distinct from *O. sativa* have been found in Africa. Nevertheless one of them appears to belong, if not to the original type, at least to a type very similar to some varieties cultivated exclusively in West Africa, and which is often found amongst the crops of typical rice introduced from the Middle East by the Portuguese several centuries ago.

The five principal species studied by the writers are as follows:

1) *O. latifolia* Desv. = *O. punctata* Kotschy. The species *O. latifolia* of the Egyptian Soudan is identical with *O. latifolia* of India and Madagascar. Chevalier found that it occurs also in Dahomey.

2) *O. breviligulata* A. Chev. et Roehrich. = *O. Barthii* A. Chev. It occurs wild in the regions of the Soudan (French Nigeria) in the

(1) See also, No. 802 B. March 1911.

the Niger and in the swamps of Baguirmi. A certain number of wildrices central and Western Africa are related to this species, and only differ in a few characters. Some of the cultivated rices of West Africa also related to this species. *O. glaberrima* Stend. is a variety of these cultivated rices, of which some show also a second variation of long ones.

3) *O. brachyantha* A. Chev. et Roehrich. = *O. Barthii* A. Chev. *parte*: in the Western Soudan and Egyptian Soudan.

4) *O. longistaminata* A. Chev. et Roehrich. = *O. Barthii* A. Chev. *parte*. Perennial rice with rhizomes, largely distributed throughout West Africa (Senegal). It is the perennial rice of Richard-Toll found in Annam (1). It is found growing with other wild rices in Nigeria, Baguirmi, Chari, Egyptian Soudan, Tanganyika, and the Belgian Congo.

5) *O. sativa* L. (*sensu lato*). Occurs wild in Annam, Cochinchina and Siam, on lands flooded during the rainy season and in rice fields which are left wet after the harvesting of cultivated rices. It is considered as a domestic rice by the natives.

Accumulated Fertility in Grass Land in Consequence of Phosphatic Manuring.
— SOMERVILLE, W. in *The Journal of the Board of Agriculture*, Vol. XXI, No. 6 pp. 481-492 + 1 pl. London September 1914.

During the past 20 to 30 years extensive areas of grass land have been treated with phosphatic manures, notably basic slag, and in most cases, with a large profit.

The initial cost of the manure, about £ 1 per acre, is, in the great majority of cases, recovered with interest in the first 3 or 4 years by the increased production of grass, so that the accumulated nitrogen and humus are practically gratuitous.

The experiments carried out by the writer at Oxford were calculated to determine to what extent the soil is enriched by the phosphatic manures applied to grass land. Samples of soil were taken from five farms which included grass fields, part of each of which had been treated with basic slag in previous years, while part had been left untreated. Two sets of 10 pots were filled with the soil from each centre, five with the treated soil and five with the untreated soil. The experiments with the soil of one farm were to be abandoned, so the results apply to four localities only. Each pot contained the same weight of dry soil, about 3 lbs., and was sown with 1 lb. of Bell oats which were thinned down to seven plants in each pot. The 10 pots filled with soil from the manured part and the five from the untreated portion of the grass land from each locality were treated as follows: Nos. 1 and 2 did not receive any direct manuring for the oats; Nos. 3, 4, and 5 were given 1 gram of basic slag, equivalent to a dressing of 15 cwt. per acre; No. 4, 0.5 gram of rape meal, equal to about 7.5 cwt. per acre; No. 5, 0.5 gram of rape meal and 1 gram of basic slag. When the plants had reached maturity they were harvested and yielded the following results:

See also, No. 802 B. March 1911.

	Total weight of plants — grams	Total weight of seeds — grams
<i>Unmanured oats :</i>		
8 pots of untreated soil	82	22.980
8 " " treated "	136	34.140
<i>Oats manured with slag :</i>		
4 pots of untreated soil	56	14.600
4 " " treated "	81	17.260
<i>Oats manured with rape meal :</i>		
4 pots of untreated soil	41	11.055
4 " " treated "	60	17.605
<i>Oats manured with rape meal and slag :</i>		
4 pots of untreated soil	46	14.110
4 " " treated "	67	19.735

Thus even the abundant manuring with rape meal and slag made a crop inferior to that due to the accumulated fertility in the grass that had received phosphatic manure.

The experiment is being continued; the same pots were sown with white mustard; at the end of August its appearance showed evidence that a single crop had not exhausted the accumulated fertility in the

The writer summarises the results as follows :

1. Phosphate manures, besides having a direct beneficial effect on grass land, are advantageous to the tillage crop grown on the broken pasture, which is likely to be improved by 50 per cent.

2. Naturally, such improvement will vary with circumstances. In the above experiments the productive power of a soil that had been dressed three times with 10 cwt. of basic slag per acre during 17 years increased 153 per cent; while another soil that had received 7 cwt. of basic slag only three years previously was improved by 124 per cent. The other two soils showed improvement of 31 and 15 per cent.

1113 - **Cotton in South Africa.** -- TAYLOR, H. W. (Assistant Chief of the Tobacco Division and Officer in Charge, Rustenburg Experiment Station) in *The Cultural Journal of the Union of South Africa*, Vol. VIII, No. 2, pp. 160-175 + 1, Pretoria, August 1914.

In those districts where the soil and climatic conditions are favorable to the growth of cotton, farmers in South Africa will find that it proves a remunerative crop for their non-irrigable lands. This has been demonstrated by experiments conducted by the Rustenburg Experiment Station of the Tobacco and Cotton Division of the Department of Agriculture where eight varieties of cotton gave yields of more than 1100 lbs. of cotton per acre. Of these, three gave more than 1400 lbs. and one variety went as high as 1684 lbs. of seed cotton per acre. Each of these varieties gave yields of more than 400 lbs. of lint and two gave more than 520 lbs. per acre.

In the Cape Province most gratifying results have been obtained. In varieties tested in Pondoland in 1911, five gave yields of more than 1,000 lbs. of seed cotton per acre, and one variety as much as 2067 $\frac{1}{2}$ lbs. of seed cotton per acre.

Experiments are just being established in Natal, but from previous results it may be said that cotton is a crop eminently suited to a large part of that Province. On the British market practically every consignment of South African cotton has realized higher prices than American cotton of similar types.

The soils which give the best results are sandy and clay loams and alkaline soils. Considering the irregularity of the climate in South Africa, the crop is not so certain on light sandy soils, on stiff clays and on turf. In the latter of which cotton germinates badly during dry seasons. As cotton is planted in October or November, it is necessary that the fall during these months and December be sufficient, or else a full crop will not be obtained; these three months may therefore be considered the critical period of cotton cultivation in South Africa.

Among the staple crops grown in South Africa, cotton is the least sensitive of soil fertility, as may be seen from the accompanying table, which gives the amounts of plant food removed from the soil by various crops.

Crop	Nitrogen	Phosphates	Potash
	lbs. per acre	lbs. per acre	lbs. per acre
Cotton	21.36	10.97	9.21
Maize	73.74	23.96	63.06
Wheat	33.32	10.20	16.82
Tobacco	56.00	7.00	69.00

At the present time this Division is not in possession of sufficient data in all sections of the Union to be able to advise what varieties to grow in each of the several districts. From the results already obtained, it may be stated that for the greater part of the Transvaal the varieties of the big-boll group, including Cleveland, Christopher, Russell's, Pollnot, Acroft and Bohemian, give the best results. In some parts of the Transvaal, where the soil is very fertile and the growing season long, the best results are obtained from Cook's Long Staple. This applies to the vicinity of Tzancien and the Brak River Valley. Along the coastal belt the returns have been secured from the varieties of the long staple group, which includes Cook's Long Staple, Nyassaland, Griffins, Sunflower and Ken's.

All the above varieties are annuals. The results obtained with the annuals have not, as yet, been sufficiently satisfactory to recommend their cultivation.

- *Urena lobata* in its Wild State in Madagascar. — DROUHARD, E., in *Colonie de Madagascar et Dépendances, Bulletin économique*, Year 14, Part 2, No. 2, pp. 142-145. Antananarivo, 1914.

This plant occurs in a wild state in Madagascar, but it is not used by the natives as a textile plant. They occasionally use it in the manu-

facture of their of ropes, but they do not cultivate it; on the contrary they destroy it by setting it on fire when it is dry, but the seeds retain vitality owing to their thick shell.

It grows in a wild state in the State of São Paulo, Brazil, and is cultivated with success in the neighbourhood of Campinas, whilst the fibre is worked in a spinning mill and weaving shed at São Paulo.

The plant is cut at the end of the flowering season and retting is carried out by the ordinary process of immersion of the fresh or dried stalks in water. The water should be clear and running with a strong current. Retting lasts from 5 to 15 days or more according to the age and thickness of the stems, the best fibre being obtained from the thinnest stems.

The process of decorticating is very simple and it is easier when the stalks are dry. The fibre is used like jute in the manufacture of sacks and cloth. A native of Madagascar can cut about 440 lbs. of green stems per day, and 100 lbs. of stems yield about 5 lbs. of dry fibre.

The crop may be sown broadcast or better by means of a drill, but it should always be sown thickly, to prevent branching and to obtain very long stems. There is little disadvantage in cutting after the maturation of the seed, the fibre being perhaps of slightly less fine quality.

Though the plant occurs in rich alluvial soils, it adapts itself also to poor soils.

1115 - *Agave Sisalana* and *Fourcroya gigantea* at Cape Verde. — *Ann. Colonial*, Year II, No. 21, pp. 289-290. Lisbon, September 25, 1914.

Agave Sisalana was introduced into Cape Verde some years ago in the form of bulbils, which were distributed amongst the agriculturists of different localities. They appear to have struck wherever planted, though they developed into good plants in the high lands and valleys, but were stunted in growth in the arid soils near the coast.

Fourcroya gigantea has been established in the wild state in the mountainous islands in the Cape Verde Archipelago for more than a century, in some places it covers considerable areas. The fibre is prepared by natives, but in such a crude manner as to render it unfit for export. In private enterprise attempted mechanical extraction with considerable success, the fibre being now sold in the markets of Hamburg, London, Antwerp and Marseilles. In 1903 the Portuguese Government carried out experiments at the National Rope Factory (Cordoaria Nacional) with textile fibres from the colonies. *Fourcroya* fibre from Cape Verde was tested and gave good results.

On the initiative of the present Governor, important plantations of *Sisalana* and *Fourcroya* have been established on certain State lands (Ruy I Cancelllo, Trindade, at an altitude of 1000 to 2500 feet). At the beginning of April, 1914, 620 000 plants had been planted and 80 000 more will be planted before the end of the year. Since the bulbils require a considerable time to grow, plants which will begin to yield in 3 years and yield about 1 ton of fibre per 1000 plants per annum after 5 years, have been bought from the natives. The present price of the fibre is £ 30 per ton.

6 - The Seeds of *Trichilia* from the Nigerian Sudan.—AMMANN, P. and VOLLMER, J. in *L'Agronomie Coloniale*, Year 2, No. 14, pp. 34-36. Paris, 1914.

The various species of *Trichilia* have not yet been thoroughly investigated, although they yield various interesting products; the bark of some of them is an excellent substitute for Ipecacuana, while their seeds contain varying quantities of fatty matter suitable for soap and candles.

M. F. PELLEGRIN, in a monograph on the Meliaceae of West Africa, enumerates 12 species of *Trichilia*, of which 6 belong to West Africa proper and 6 to Equatorial Africa. The six species belonging to West Africa are: *T. Priureana* A. Juss, *T. emetica* Vahl and *T. Hendelotti* Planchon, of them small trees belonging to the savanna region; *T. acutifoliata*, *Candollei* and *T. cedrata*, all three described by A. Chevalier and forming trees in the virgin forests of the Ivory Coast.

The seeds of *T. emetica* have been exported from Mozambique to Maritzburg for a long time under the name of *Majuraires*. It was therefore desirable to know if the West African products gave seeds of equal value. They were therefore obtained from various species found between Bamako and Koulikoro and studied at the Chemical Laboratory of the Colonial Garden of Vincennes. The types of seeds were as follows:

- I. Small dark red seeds.
- II. Medium-sized seeds of orange vermillion colour.
- III. Large orange-coloured seeds.

The results of the analyses are given in the Tables I and II.

TABLE I. — Analysis of seeds.

	I	II	III
Weight of 100 seeds, gms	12.7	29.4	79.1
" " 100 kernels, gms	4.68	17.08	46.04
Percentage of kernels in seeds	36.9	58.1	58.2
Shells %	63.1	41.9	41.8
Moisture % in shells	6.42	4.16	4.74
" " in kernels	5.73	6.71	5.76
Fat in shells	41.50	38.10	51.90
" " kernels	30.10	44.70	43.70

TABLE II. — Analyses of the fats.

	Medium seeds.	Large seeds.	
	Fat of kernels	Fat of kernels	Fat of shells
Colour	light brown	light brown	lighter brown.
Solidification point of glycerides	18°-19°	15°-16°	about 13°
Acidity % as sulphuric	0.97	0.49	0.53
" " % as oleic acid	5.60	2.82	3.05
Fixed insoluble fatty acids %	92.0	90.3	92.0
Melting point of insoluble fatty acids	52°	51.5°	44°
Solidification point " " "	48.4°	47.2°	40.5°
Glycerine %	6.3	—	5.8

The large seeds most nearly approach the Mafuraire from Mozambique as regards size and fat content. The medium seeds are identical with those of *T. Priureana* preserved in the Kew Museum.

French West Africa should be able to export at least several hundred tons of the Mafuraire seeds each year.

1117 - **Recent Data on Rubber Plantations.** — Plantation Rubber Acreage. — Rubber Planting in Malaya. — WILLIAMS, G. C. (Rangoon): Rubber Cultivation in the Straits Settlements. — Report of Gold Coast Government. — *The India Rubber World*, Vol. 4, No. 6, pp. 678 New York, September 1, 1914. — Rubber Cultivation in India *Daily Consular and Trade Reports, Issued by the Bureau of Foreign and Domestic Commerce*, Year No. 197, p. 1034. Washington, August 22, 1914.

The area under rubber in 1913 is estimated at 1 250 000 acres, distributed as follows:

Malaya, etc.	500 000	acre
Java.	150 000	"
Sumatra, etc.	250 000	"
Ceylon	220 000	"
India and Burma	50 000	"
German Colonies	60 000	"
Borneo	20 000	"

In 1910 the total acreage under rubber was 767 000 acres, in 1911 865 000 and in 1912, 987 000. It will thus be seen that the increase shown by 1913 over 1912 is about 27 per cent.

The following table shows the relative importance of the rubber area in various parts of the Malayan peninsula:

	1912 Acreage	1913 Acreage	1913 Output in tons
Federated Malay States . . .	399 197	433 324	21 229
Straits Settlements	94 263	111 316	6 047
Johore	91 827	117 022	1 646
Kelantan and Kedah	34 837	45 373	246
Trengganu	1 497	1 510	Not yet produced
	621 621	708 545	29 168

In 1912 there were in all 235 912 workers employed on the Malay estates.

The production of rubber in India is confined to Assam, Burma and Madras Presidency, which exported in the fiscal years ending March 1913 and 1914, 14 627 and 23 264 cwt. respectively. The acreage under rubber and the number of trees in 1913 was as follows:

	Acres	No. of trees
Assam	4 681	137 430
Madras	12 022	1 636 476
Burma	29 544	4 911 399

The yield of the Assam plantations is relatively small and the number of acres to the acre much less than in Madras and Burma. In 1913 the outturn in Madras was still more than double that of Burma, because most of the trees in Burma, being less than six years old, are not yet productive.

In 1914 the total acreage under rubber cultivation was about 34 000 acres.

The rubber-growing districts are in Lower Burma, including Tenasserim.

The soil is principally a reddish yellow friable sandy loam, with some districts which have a subsoil of laterite. The land is easily drained.

It is slightly undulating and in nearly all cases is protected from the south-west monsoon by high ranges of hills.

The rainfall varies slightly in different districts, from 110 inches in the Tenasserim to 200 in Tavoy. There are two seasons: December to April, the dry or cold season, and May to November, the wet or monsoon season.

The driest months are February and March, when there is very little or no rain, but there are heavy mists and dews which compensate for the lack of rain.

The temperature is about 88.8° F. in the daytime and 74° F. at night—the mean temperature for the year being about 80° F.

All planting is stump planting about 9 to 12 months old. The plants are at a height of from 10 to 12 feet and a girth average of 2 1/2 to 4 inches per year.

All the trees can be tapped in 4 years from the date of planting, the girth average 3 feet from the ground being 18 to 24 inches and more if the trees are 20 x 20 feet.

The average yield for 4 to 6 year-old trees is about 3 lbs. per tree per year. The rubber is of excellent quality. Tapping is done now practically all the year round. It is principally done by Chinese girls.

The capital invested is from £ 22 to £ 25 per acre to bring to bearing, the average cost of production is about 1s 6d to 1s 10 1/2 d per pound.

The exports of rubber from the Gold Coast Colony in 1912 were 1 669 lbs. as against 2 668 667 lbs. in 1904. The average annual yield of Para rubber (Hevea) at the several experimental stations was 3 3/4 lbs. per tree.

Funtumia has given over 56 per cent of its total yield at the first tapping, in contrast with Para, where the quantity of latex tends to increase after the first tapping.

1. — Rubber: Tapping and Tapping Systems. — SPRING, F. G. (paper read at Batavia Rubber Congress) in *The India Rubber Journal*, Vol. XLVIII, No. 14, pp. 15-16. London, October 3, 1914.

Under normal conditions from 300 to 350 trees per tapping coolie per day are recommended if work of good quality is to be maintained.

At least twenty cuts to the inch of bark removed should be obtained, and when four years is allowed for bark renewal the cuts should be 18 inches apart.

The depth and uniformity of cut are extremely important. It is considered a bad practice to place water on the cuts to facilitate the flow of latex.

In discussing the merits of the different tapping systems two points require consideration: 1) the production of maximum yield of rubber with minimum cost, and 2) the maximum yield of rubber with minimum injury to the tree.

With regard to the periodicity of tapping it is generally

recognised in Malaya that daily tapping, over a period, gives total rubber than alternate-day tapping, but that the latter yields per tapping. In the case of young rubber, the difference is at its minimum, but as the tree ages the excess of rubber obtained in daily tapping increases and becomes sufficient to pay for the additional labour involved. This age limit appears to be about six years for trees planted at sufficient distance apart to allow good bark renewal. Bark renewal depends on the age of the trees and their distance apart.

At least four years should be allowed for bark renewal in the case of young trees and six years for old trees, especially if the distance of planting is small.

The writer has conducted experiments to test the merits of the following tapping systems:

1. *Opposite quarter system.* — This system is unsatisfactory on account of the high cost of marking out the guiding lines, tapping, calking latex and washing cups, and requires double the number of latex cups, spouts and holders. It is also doubtful if the renewal of bark in this system is as rapid as in others.

2. *Single quarter (or half herringbone) system.* — This system is largely in use in the Malay Peninsula. At the Kuala Lumpur Experiment Station it was found that two cuts gave considerably more total rubber than three in the case of young trees, and since the length of the cuts increases with the age of the tree, it is doubtful if it is advisable to make more than two cuts even with old trees. It has been found in Java that more rubber is obtained by tapping to the left than to the right of the vertical channel. This system is infinitely superior to the opposite quarters system and over a period of two years it has given results nearly equal to the 'V' system. The superiority of the latter system can only be decided until the results of tapping the renewed bark are known.

3. *The 'V' system.* — Some planters object to this system because it tends to flatten out the trunk of the tree. This is however no disadvantage and the results of the Kuala Lumpur experiments show a gradual and continuous increase in yield greater than that of any other system.

1119 — *The Use of Sweet Sorghum as a Source of Commercial Sugar or as Food*
ANNETT, H. E., (Agricultural Chemist to the Government of Bengal) in *Agricultural Research Institute, Pusa, Bulletin* No. 41, 9 pp. + 2 diagrams. Calcutta, 1914.

From time to time attempts have been made to grow sweet varieties of sweet jowar (*Sorghum* sp.) for the purpose of sugar production. Sweet sorghum seed has in many cases been imported from America, but in certain parts of India local varieties are found which contain much sugar.

The experiments here described were made at Lyallpur and at Ludhiana, Punjab.

At Lyallpur a local variety was grown. It was sown on July 1st at the rate of 12 lbs. per acre, without manure; the ground was irrigated twice. In order to determine the best time for the harvest, the

(1) See No. 1039, B. Sept. 1913.

was divided into 20 equal sections which were gathered two at a time at different intervals. From every lot the juice was boiled down. The results were obtained from the sections cut towards the end of October beginning of November. The lot cut on November 9 yielded 6 tons to acre of stripped cane with 6587 $\frac{1}{2}$ lbs. of juice, and from this 875 lbs. of sugar (gur), or 13.3 per cent, containing 57.90 per cent sucrose and 1 per cent reducing sugar, were obtained. This is quite a poor quality gur.

From the results of the Lyallpur and Gurdaspur experiments it appears that as a source of sugar, saccharine jowar is not worth growing in India. In America it is only grown to make syrup, for which there is a demand in that country, while there is none in India.

The high glucose ratio of the juice militates against the production of crystalline gur. The juice contains also substances which produce, besides, a very objectionable taste in the gur.

The yield per acre obtained from a very good crop of sorghum only worked out at about 8 cwt. per acre. Hence the yield of sugar per acre would be only about one-third of that from the average country sugarcane crop.

These results tally with others obtained previously at Poona with the Amber and Amber varieties, which yielded 1174 and 1072 lbs. of molasses per acre respectively.

The experiments made by the writer indicate that the total sugar content of the crop is highest when the seed contents begin to dry. Therefore until the seeds are dead ripe the total sugar in the crop decreases, but the decrease is mainly at the expense of the reducing sugar. As the plant reaches ripeness the amount of juice expressed from it decreases.

As a source of fodder saccharine sorghum seems valuable. The crop is very quick-growing and, as has been seen, yields abundant green produce. When the seed is in the thin milk stage no increase in total weight of the crop takes place and also the amount of total sugar in the crop has almost reached its maximum. Hence, when being cut for fodder, the crop should not be allowed to get beyond this stage.

Tea: Manuring Experiments at Peradeniya.—BAMBER, M. K., in *Department of Agriculture, Bulletin* No. 9, pp. 119-134, 3 plates, Colombo, Ceylon, May 1914.

This circular contains a detailed account of the results of manuring experiments on the tea plots at Peradeniya since 1911. Though no obvious conclusions are drawn from the tabulated results, the writer states that the experiments continue to bear out the advantages of green manuring, and demonstrate that with this class of tea, the application of expensive indigenous manure is not essential for the production of highly profitable yields.

As a green manure, *Dadaps* (*Erythrina lithosperma*) appears to give the best results.

1121 - *Iris*es Used in Scent-Making. — BLIN, HENRI, in *Le Jardin*, Year XXI, No. 659, pp. 230-231. Paris, August 5, 1914.

France does not produce sufficient iris rhizomes to supply the scent-tory at Grasses (Alpes Maritimes), where 650 000 lbs. are required annually; therefore there is a large importation of these roots from Tuscany. Further the Italian product is of superior quality to the French. The writer is of opinion that iris cultivation might be extended in the South of France and especially on the somewhat poor soil of the coast zone, which is far from the centres of perfume manufacture.

The scent iris was grown for a long time in the Department of the Ain, in the communes of Angfort and Carbonnot, near Seyssel. The crop has, however, decreased in importance owing to the competition of South of France and of Italy. In 1903, the above-named communes produced from 33 000 to 35 000 lbs. of iris rhizomes, which fetched from 2 to 50s per cwt. The price has now fallen to about half this. Iris from Florence make 35 to 50s per cwt., while the less valuable ones from Verona are sold at 25 to 30s.

The varieties most used in scent-making are *Iris florentina* (*I. palli*) and *I. Clio*, which is a variety of it. *Iris germanica*, which is coarser and harder, grows wild throughout Provence.

The soil is prepared by digging, and fragments of the rhizomes planted at 8 inches each way, towards the end of August and in September. They are hoed in spring and autumn. From 6 to 8 tons of manure applied per acre to every crop, which occupies the ground for two or three years. In the South of France, good results are obtained by the application of 6 to 8 cwt. per acre of sesame or oil cake. The rhizomes are lifted at the end of the second or third year. The French crops vary from 20 to 36 cwt. of dry rhizomes per acre. An average crop of 28 cwt. per acre fetching 28s per cwt., gives a gross return of £ 40 per acre.

The rhizomes are peeled, washed, dried in the sun and kept in a dry place. The old method of making the scent consisted in grinding the roots and thus obtaining iris powder (which is itself used for many purposes). The essence was distilled and the residual powder macerated in pure alcohol, either the essence or the maceration liquid being used. The better and more modern method is the process of extraction by means of volatile solvents such as dichlorethylene or trichlorethylene; the latter is preferable for manufacture on a large scale.

1122 - The Effect of Shading on the Transpiration and Assimilation of the Tobacco Plant in Cuba. — HASSELBRING, HEINRICH, in *The Botanical Gazette*, Vol. LVII, No. 4, pp. 257-286, + 1 fig. Chicago, Ill., 1914.

The experiments described in this paper were undertaken in the years 1908-09 at the Cuban Agricultural Experiment Station at Santiago de las Vegas (Western Cuba) with the object of determining the effect of shading on transpiration and assimilation in the tobacco plant of the cheese-cloth shade which is frequently used in that region for shading tobacco. The cheese-cloth is a kind of network of coarse thread with meshes about a tenth of an inch wide; during the middle of the day this cloth casts a bar-

ptible shadow, which, however, is more noticeable early in the morning than in the afternoon.

Six tobacco plants were grown in vessels in the open, and six under cheese-cloth shade. The light intensity under the two conditions was measured by the photometric method. The temperatures were recorded by thermographs; the relative humidity and rainfall were also determined. It was observed that:

1. The shade of the cheese-cloth tent reduced the total light by about one-third, but the diffuse light showed very little difference on bright days; when, however, there was no bright sun the total light (all diffuse) was reduced by about one-third.

2. There was no marked difference between the temperature within the tent and that outside. The average daily excess of the temperature inside the tent over that outside was, for 60 days, 0.14° F. It seems that the tendency of the tent to retain heat is balanced by the smaller quantity of radiant energy which passes into it.

3. The relative humidity is higher inside the tent than outside, the difference being more marked during the day, for at night in both stations it reaches 100 per cent. During the day the difference is caused by the partial retention of the moisture transpired by the plant.

4. The rate of evaporation is greater in the open than under the tent. The difference in the rates of evaporation in the two stations increases with the development of the plants and the consequent increase in relative humidity under the cheese-cloth. Besides diminishing the amount of light increasing the relative humidity, the tent reduces the currents of air; these changes tend to diminish transpiration.

The plants used in this work were grown from seed obtained from a single self-fertilized mother-plant of a pure strain.

The shade plants attained a nearly uniform height of 6 ft. 10 in., while the height of the sun plants averaged about 5 ft. 9 in. The leaves of the shade plants were much larger and thinner than those of the sun plants and the internodes of the stem were longer. In 60 days the plants in the open transpired an average of 45.539 litres of water per plant and shed 247.72 cc. of transpired water per gram of water-free substance produced, while the corresponding figures for the shade plants were 35.212 litres and 186.90 cc. The sun plants thus transpired on the average about 30 per cent more water per plant than the shade plants, while the average weight of dry matter produced was, in the mature plants, nearly the same in both sets. It follows that the series having the higher total transpiration also has the highest transpiration per gram of dry plant substance. This is corroborated by the above figures. The quantity of water transpired per unit of dry matter produced is remarkably uniform for the plants in each group. This confirms the conclusion that under the same cultural conditions the quantity of water transpired per unit of dry matter produced is constant and independent of the nature of the nutritive solution or of their concentration or of the state of development of the plant.

The other observations gave the following averages per plant:

	Plants in the open	Plants shade
Leaf area, in square centimetres	21 442	29 442
Transpiration, total for the last five days, in cc. .	10 566	7 862
" hourly per sq. decimeter leaf surface,		
in cc.	0.412	0.224
Fresh weight, in grams:		
leaves	401	469
stems	380	489
roots	212	205
total	993	1162
Weight of water-free substance of plants (at 78° C. and at a pressure of 6 cm. mercury) in grams		
leaves	74.50	66.94
stems	68.66	79.68
roots	45.26	41.51
total	188.42	188.14
Percentage of water.		
leaves	81.39	85.68
stems	81.91	83.71
roots	78.59	79.70
total	81.01	83.82

* After a discussion of the observations and opinions of the most competent authorities on the subject of the relation between transpiration and production of plant substance, the writer draws the following conclusion:

Under the climatic conditions of Western Cuba the transpiration of tobacco plants grown in the open ground is nearly 30 per cent greater than that of plants grown under the cheese-cloth shade commonly used for shading tobacco in that region. The transpiration per unit area of leaf surface is nearly twice as great in the sun plants as in the shade plants.

The shading of tobacco plants by this grade of cheese-cloth does not seem to result in a diminished production of total plant substance by the shaded plants, as compared with other like plants not shaded. Since, however, the leaves of the shade-grown plants have a much greater total area than those of the plants grown in the open, it is evident that the quantity of plant material elaborated per unit of leaf area is greater in the plants grown in the open.

Although the total production of dry plant substance is not influenced in any marked degree by the cheese-cloth shade, the distribution of the substance is affected in such a manner that in the shade-grown plants relatively less material is deposited in the leaves and more in the stems than in the corresponding organs of the plants grown in full light. No evident influence is exerted on the deposition of material in the roots.

1123 - Medicinal Plants in South Africa. — SCHÖNLAND, S., (Professor of Botany Rhodes University College) in *The Agricultural Journal of the Union of South Africa* Vol. VIII, No. 2, pp. 201-205. Pretoria, August 1914.

In South Africa the native medical practitioners make use of a number of local plants; very few of these, however, are included in the official pharmacopoeia.

copoeia. Among these the following wild plants may be mentioned: *Cassia nigra*, which is widely spread in South Africa; *Cannabis sativa*; several species of *Cassia*; *Datura Stramonium*; *Foeniculum vulgare*; *Strubium vulgare*; several native species of *Polygala*, which appear to be at least as good as *P. Senega*; *Ricinus communis*, etc.

Numerous other medicinal plants have been grown here and there in South Africa, but rather for experimental or ornamental purposes and without attaining any commercial importance. Among these the following have been successful: *Aloe* (Barbados) at Grahamstown and Capetown; *Aspidium ahamanticum* Kze, which is said to be superior to male fern, at Durban; *Carum Carvi* near East London; *Cassia marilandica* at Komgha; *Hamamelis* *Cassia* at Durban and Maritzburg; *Convolvulus Scammonia* Somerset East; *Coriandrum sativum* near East London; *Curcuma longa* in Natal; *Digitalis purpurea* in Albany; *Erythroxylon coca* in Natal; *Erigeron glabra* near East London; *Illicium verum* in a garden at Komgha as an ornamental plant; *Linum usitatissimum*; it grows freely at Komgha and Kei River, and has been very successfully grown near East London in Lower Albany; *Matricaria Chamomilla*, grows freely at Komgha and has been grown at Salem for many years; *Mentha piperita*, successfully grown in several localities; *Pimpinella Anisum* near East London; *Pyrethrum* spp. have been grown very successfully for local consumption in South-east Cape Colony; *Rheum officinale*, successful at Komgha; *Tamarindus indica*, grows freely at Komgha, also grown at Durban, where it does not bear so freely enough to make it worth cultivating; *Taraxacum officinale*, at East London.

Considering the special economic conditions of South Africa and especially that labour is expensive, mostly unskilled and unreliable, the writer does not believe that an important export trade in medicinal plants could be built up, even with those abundantly growing wild.

4 - Market Gardening in Spain. — ZULUETA, JOSÉ (Report presented to the VIII Curso Internacional de Expansión Comercial) in *Resumen de Agricultura*, Year XXVI, Part 309, pp. 390-398. Barcelona, September 1914.

The exportation of market-garden produce from Spain is continually increasing with the improvement of the means of communication. According to the last available official statistics, those of 1912, the exports during that year were as follows:

	£
Onions	624 873
Preserved vegetables	370 550
Potatoes	278 270
Chillies, ground and unground.	181 315
Garlic	87 908
Tomatoes	37 382
Peas	10 930
Artichokes	650
Capsicums	159
Asparagus	29
Various vegetables	9 583

The statistics estimate the value of the annual vegetable production of Spain at 15 millions sterling. The writer, however, considers that this estimate falls far short of the reality, seeing that vegetables form the principal articles of food of the people. The above figures do not include all the vegetables consumed by the producers. Very many families possess kitchen gardens; even agricultural labourers and some towns-folk and factory hands possess them.

With the exception of Madrid, where the scarcity of water in the Manzanares precludes irrigation, all the large centres of population in Spain are surrounded by belts of market gardens. In the central "meseta" (plain), the first place is occupied by Aranjuez, with its 30 000 acres of well irrigated land thickly covered with market gardens and associated fruit plantations. In Aragon the irrigated land of Calatayud is noted, however, both in this district and in the "vegas" (fertile, gentle irrigated slopes at the foot of the mountains) of Saragossa, sugar-beets and lucerns predominate, so that market gardening has little commercial importance. The valley of the Ebro is only to a limited extent under intensive cultivation; however, Logroño-Haro should be singled out, as it supplies a large preserve trade.

The typical market-garden zone which produces early outdoor vegetables, is the coast zone of the Mediterranean. From the town of Mataró the "huerta" (irrigated fruit and vegetable garden), extending as a long narrow belt along the coast from the suburbs of Barcelona to the French frontier, takes its name. Its speciality is in early potatoes, which are planted in November or December, and forced by the application of an abundant supply of manure; these potatoes are sent, in constantly increasing quantities to Paris and to England and elsewhere at a time when the tubers are still green. The annual exportation is estimated at 33 million lbs. and its value at £120 000; but the price varies very much according to the greater or less competition of the products of other warm countries. The exportation of green peas is estimated at 3 ½ million lbs., with an average value of £12 000; these are grown without irrigation between rows of vines. In the "huerta" of Mataró no fruit trees are grown, while the more extensive plain of the Llobregat, which occupies the whole delta and extends some miles up the valley, is an uninterrupted fruit plantation, with vegetables below the trees.

According to official data, which, however, fall below the actual figures, the province of Barcelona possesses 16 200 acres of market gardens of which the produce is worth £1 290 000. The name of "huerta" is not given to the cultivated zone extending between Rens and Tarragona; nevertheless the scanty water supply available is turned to such good account, that large crops of vegetables are also obtained there. The "huerta" proper commences in the Castellón plain and includes all the ancient kingdom of Valencia, where it reaches its greatest perfection. The Villareal "huerta", which now comprises about 2500 acres, uses subterranean water brought to the surface from a depth of about 200 ft. by means of Artesian wells with mechanical motor pumps. On a

range there is one well for every 57 acres of land, which is for the most part under citrus groves. The soil was prepared according to the system used in Santa Cruz (Teneriffe) in preparing the land for the celebrated Canary potatoes: the solid rock is blown up with dynamite, the layer of earth beneath extracted, the cavity is lined with fragments of rock and filled up with loam. At Villareal, however, the soil was transported for a long distance in order to obtain a layer 20 in. deep. The same thing is done at Almeria in order that the roots of the famous vines can penetrate deep into the soil and thus resist the drought. In the "huerta" of Valencia the cultivation is so intensive that there are families living upon little over an acre of land.

The "huerta" of Murcia is distinguished by the cultivation of capers. Vegetables are grown there in trenches covered during the winter with straw matting. Orihuela, Denia, Gandía, the "vega" of Granada and Motril are all important horticultural centres. The Motril zone is specially characterised by the cultivation of cotton and sugarcane.

The prices of "huerta" in full production are exceedingly high, rents amounting to £10 or £16 per acre and sale prices usually to £200 to £300 per acre. At Carcagente, Alcira and Gandía, citrus groves fetch as much as from £650 to £800 per acre.

As a rule, the ground is leased to families of colonists who usually do the work; day labourers are very rarely employed. The management of the soil and the crops is carried out with the greatest exactitude.

A Kaki Classification. — HUME, HAROLD H., in *The Journal of Heredity*, Vol. V No. 9., pp. 400-406 + 6 figs. Washington, September 1914.

As long as any kind of fruit is represented by only a few varieties the analytical classification can be followed, but when the number of varieties increases considerably, it becomes necessary for the pomologist to introduce a new system of classification based on some well-marked characteristic in order to facilitate identification and handling.

Such is the case with the Kaki (*Diospyros Kaki*) of which the number of varieties grown in the United States for many years has been quite limited. But recently a very large number of new varieties have been introduced from China, Japan, Algeria, France, etc.

The writer is of opinion that the flesh characters form a satisfactory basis of classification. In the final analysis the flesh characters are fixed by the pollination factor and this factor finds its most striking expression in the colour and texture of the flesh.

All the varieties of *D. Kaki* known in America at this time are light coloured when seedless, while certain varieties always show darkening of the flesh when seeds are present and other varieties are always light fleshed when containing seeds. Thus far in the writer's experiments parthenocarpy, that is the formation of seeds without pollination, does not occur in *D. Kaki*, and if it does it is so rare as to have no practical importance. In *D. virginiana* it is said to have been observed in some instances, but it has not been proved experimentally.

Kakis may be divided from the pomologist's point of view into at least two groups — first those which show no change in colour under the influence of pollination, and second those in which the flesh of the fruit is darkened under the influence of pollination.

Since the change in colour in the one case is directly due to pollination and in the other pollination has no effect, those varieties which undergo no change in color are called *Pollination Constants* and those which are light coloured when seedless and dark coloured when containing seeds are called *Pollination Variants*. If varieties which are constantly dark fleshed whether seedy or seedless should be found, they would belong to the group of *Pollination Constants*, which would be divided into two groups of light and dark fleshed *Pollination Constants*. It is hardly probable that there are varieties which are dark fleshed when seedless and light fleshed when seedy.

The varieties known at this time are divided as follows :

Group I, *Pollination constants*, Costata, Hachiya, Lienha, New Sien, Ormond, Phelps Siang, Tamopan, Tanenashi, Triumph, Tsuru.

Group II, *Pollination Variants* : Dai Dai Maru, Gailey, Godbey, Hyakusae, Lonestar, Masugata, Myotan, Nectar, Okame, Taber No. 23, Taber No. 129, Yeddoichi, Yemon, Zengi.

The amount of dark flesh found in fruits of varieties of the group *Pollination Variants* depends both upon the number of seeds and upon the location with reference to one another : It is partial or arranged round the seeds when only one or two close to each other are present ; if two seeds are present diametrically opposite one another, or if there are more than two seeds, the whole area may be more or less darkened.

Associated with the changes in the colour of the flesh there are well marked variations in time of ripening, shape and size of fruits, quality and texture of flesh.

Considering the extraordinary variability shown by *D. Kaki* due to cultivation, it is not improbable that the present cultivated varieties are derived from two distinct species.

Certain varieties of kakis bear both staminate and pistillate flowers. Some of those which bear staminate flowers do so every time the tree blooms while other varieties are very irregular in this particular. The first class of staminate trees are designated as *Staminate Constants*, while the second class may be called *Staminate Sporadics*. Those which produce only pistillate flowers may be referred to as *Pistillate Constants*. It is interesting to note that staminate-flowering varieties of both classes are more commonly found among the *Pollination Variants* than among the *Pollination Constants*. To the former group belong Gailey, Masugata, Okame, Taber Nos. 23 and 129. Among the *Pollination Constants* only two staminate-flowering sorts, viz. New Sien and Siang, have so far been found. It is not improbable that they belong to a different species from the other varieties or at least a different section of *D. Kaki*. These two varieties were recently introduced from Northern China. It must be borne in mind that *D. Kaki* is not native to Japan, but was introduced from China several centuries ago ;

about the two groups (light-fleshed and dark-fleshed) have diverged sufficiently, even granting that they were originally one.

The different varieties so far studied may be grouped on the flowering habit as follows:

Group I: *Pistillate Constants*. Tanenashi, Hachiya, Costata, Tsuru, Umopan, Hyakume, Yenon, Yeddoichi, Phelps, Triumph, Zengi.

Group II: *Staminate Constants*. Gailey, and probably Masugata, Siang P. J. No. 21910 and S. P. J. No. 27037).

Group III: *Staminate Sporadics*. Okame, Taber No. 23, Taber No. 129.

Experiments conducted by the writer tend to prove that it is possible to select for transformation strains of staminate sporadics into staminate constants.

20 - **The Siamese Seedless Pomelo.** — BOYLE, H. H. (Bureau of Agriculture, Manila, P. I.) in *The Journal of Heredity*, Vol. V, No. 10, pp. 440-444 + 1 fig. Washington, October 1914.

In 1902 the Office of Foreign Seed and Plant Introduction of the U. S. Department of Agriculture introduced from Bangkok some plants of the Siamese pomelo which had been described as seedless. But the only plant which reached Washington alive produced fruit which contained many seeds and was decidedly inferior; it was consequently destroyed.

In 1912 the writer was sent by the Philippine Bureau of Agriculture to Siam to study the seedless pomelo on the spot and to obtain plants for it. He was able to find it about 30 miles to the north-east of Bangkok and in the Nakon Chaisii district, which produces the best pomelos. He found that some trees bore only seedless fruit, but some also bore fruit with seeds, especially those trees which stood on the side of the grove nearest the ordinary seminiferous pomelo trees; the presence of seeds was apparently due to cross-pollination. The seedless pomelos are all propagated by marcottage by the natives, to whom budding is unknown. In research work carried on in the United States it had already been observed that the seedless navel orange bore seeds when crossed by pomelo.

The writer classifies the seedless pomelos of the Nakon Chaisii district according to four types:

1. Medium size, 4 1/2 inches in diameter by 5 inches in length; colour light yellow; flesh white; taste very aromatic, free from bitterness.
 2. Medium size, 4 7/8 inches in diameter by 3 1/4 in length; colour light yellow; flesh white; taste aromatic and excellent.
 3. Medium size, about the same as No. 1, pyriform; colour orange yellow; flesh pinkish white; taste good, rather heavy.
 4. Size very large; colour yellow; flesh deep pink; taste bitter.
- Type 1 is the finest of all, Types 2 and 3 are the commonest, while Type 4 is inferior to the others.

The Siamese seedless pomelo has been introduced into the Philippines and into the United States.

1127 - *Prosopis juliflora*, the Mesquite or Algaroba Tree, and *Prosopis pubescens*, the Screw Bean. — ROBERTSON, C. C. (Research Officer, Forestry Department) in *The Agricultural Journal of the Union of South Africa*, Vol. VI No. 2, pp. 233-239. Pretoria, August 1914.

The Mesquite or Algaroba and the Screw Bean or Screw Pod Mesquite deserve to be introduced and grown for their pods, which are excellent fodder for live stock.

Prosopis juliflora, the mesquite, is widely distributed in North America from Western Kansas to California and southwards into Mexico, and probably various forms occurring in Central and South America and the known as algaroba should be included in the same species. Even in the United States the species varies a good deal, and two extreme forms, the varieties *glandulosa* and *velutina*, are recognized.

The mature pods are yellow, or often tinged with red, and are about four to nine inches long and one-third of an inch wide, and contain about six to twenty seeds embedded in pulp.

In its home in North America, *Prosopis juliflora* is found in the hotter drier parts of the country, where the average annual rainfall is about 25 inches; it occurs even in arid localities where the rainfall is as low as 10 inches. It develops a remarkably long taproot, which enables it to derive moisture from a great depth and to become independent of the surface water supply. It grows to a height of from 3 to 20 feet. The *velutina* variety reaches its greatest height of about 40 feet and a diameter of 1½ to 2 feet in the valleys of Southern Arizona. The species is said to be extending its range naturally in some of the prairie States, and in California will grow on soils containing a large proportion of carbonate of soda.

Prosopis juliflora has been naturalized in several countries. It is abundant in the drier parts of the island of Jamaica, where it grows in dry gravelly soils. In the Hawaiian Islands it has spread rapidly since its introduction about 70 years ago and now covers an area of at least 50 000 acres on the south and west coasts, where it is protected from the trade winds. It grows on gravelly soils and steep stony slopes, occupying land which is worthless for other purposes.

In some of the drier parts of India, *Prosopis juliflora* is now naturalized and has proved extremely hardy to drought and is used for reforesting desert waste lands and for arresting drift-sands. The tree is also said to be naturalized in the Philippine Islands and in Australia.

In German West Africa it was introduced about thirteen years ago and seems to withstand the drought well and to grow on poor soil.

Seed of *Prosopis* and its varieties has been imported from different sources by the Forest Department of the Union of South Africa at intervals during the last seventeen years. It seems to thrive in the different localities in which it has been planted, but its growth has been somewhat slow and bushy, and the writer recommends it for hedges and for arresting sand-dunes.

Wherever it has been introduced it is extending its range naturally by regeneration from seed which is disseminated by stock in the droppings. It is of slow growth. Its wood is heavy, hard and close-grained.

as been used for railway sleepers, wood-paving, fence-posts and furniture. It is an excellent firewood and makes good charcoal. The flowers are eagerly sought by bees. The pods are relished by cattle, horses and form an important stand-by for times of drought. About 53 per cent of their weight is nutritious and consists of vegetable albumen, grape-sugar, with traces of fat and salts. The Mexicans and Indians grind the pods into a coarse flour which bake into cakes for food. In the Argentine a liquor is distilled from pods.

Prosopis pubescens is distinguished from the other mesquite by its pods which are twisted into a spiral. Its wood is similar to that of *aliflora*. The pods, although nutritious and used for fodder in America are of less value because of their smaller size. This species has also been successfully introduced into South Africa.

- **The Jaboticaba (*Myrciaria*).** — POPPONG, WILSON (Agricultural Explorer, U. S. Department of Agriculture), in *The Journal of Heredity*, Vol. V, No. 7, pp. 318-326. Washington, D. C., July 1914.

The jaboticaba is a fruit tree belonging to the Myrtaceae, indigenous to central and southern Brazil. Berg distinguished three species: *Myrciaria cauliflora*, *M. jaboticaba* and *M. trunciflora*; but they are not distinguishable with certainty, at any rate under cultivation.

The tree, which is evergreen, may reach 30 to 40 ft. in height; it arches from the ground, producing an almost spherical crown. The fruits are borne on the branches from the ground-level to their tips; they are early sessile in *M. cauliflora*, but in *M. jaboticaba* are produced on short peduncles less than an inch long; they ripen within two or three weeks of the flowering period, and a tree may flower and fruit several times during the year. In appearance the fruits rather resemble large grapes, reaching 1 in. or more in diameter in *M. cauliflora*; the most common colour is a deep maroon purple; the skin contains tannin and is leathery, while the pulp is translucent and juicy, in flavour something like grapes; each fruit contains from one to four seeds.

The jaboticaba will not stand more than the lightest frosts; it seems to prefer a rich, deep soil. The trees should be planted 30 ft. apart; when raised from seed (which is the usual method of propagation) they require about eight years to come into bearing.

- **Manurial Experiments on Coconuts at Peradeniya.** — BAMBER, M. KELWAY.

U. S. Department of Agriculture, Ceylon, Bulletin No. 10, pp. 135-146. Colombo, May 1914.

These experiments were conducted, to determine the effect of manurial constituents, alone and in combination, on the development and formation of coconuts and to what extent old coconut palms can be improved by means available to most cultivators. The trees used were all old, growing on a heavy loam at an elevation of about 1600 feet and about 51 miles from the sea in a direct line. The rainfall of the district varied between 62.37 inches in 1908 and 120.70 inches in 1913 and averaged 83.35 inches.

The results tend to show that:

- 1). Ploughing twice a year is as beneficial as manuring.
- 2). Tying cattle to the trees in 1911 and 1912 had an immediate effect lasting over two years.
- 3). The application of a soluble manure twice annually and a general manure annually produced a steady increase which was maintained during 1913.
- 4). Green manure with basic slag and sulphate of potash showed a marked improvement, which, however, was not fully maintained during the wet season of 1913.
- 5). The application of salt (NaCl) or nitrate of soda has had a beneficial effect during the years of the experiment.
- 6). No treatment of any kind results in a gradual falling off in yield.
- 7). The effect of cultivation and manuring has not so far decreased the number of immature nuts (1) falling annually.
- 8). The number of mature and immature nuts increased annually while the proportion of female flowers producing mature fruit showed a steady decrease during the same period.
- 9). The reduction of the percentage of mature nuts to female flowers is rather more marked in the manured plots than in the unmanured; the percentage increase of total female flowers is more marked in the manured plots.

1130 - **The Manuring of Bananas** (2). — BRÜNNICH, J. C. (Chemist of the Department of Agriculture and Stock, Queensland) in *The Queensland Agricultural Journal*, Vol. Part 2, pp. 132-141. Brisbane, August 1914.

Hitherto, in general, large areas under bananas have been for years continually cropped, without any attention to manuring, and abandoned when the crop, became unprofitable owing to exhaustion of the soil.

In the State of Queensland it was found that the abandoned banana lands were eminently suitable to other crops and more particularly sugarcane, and thus the great waste of leaving stretches of land uncultivated was avoided, but the production of bananas, which in 1898 had 14 ½ million bunches, dropped to an average yield of a little over 1 million bunches in the last few years.

Several manurial experiments carried out in Southern Queensland under sub-tropical conditions, gave excellent results and demonstrated that exhausted banana lands may, by thorough cultivation and heavy dressings of fertilizers, produce crops equalling those obtained from virgin lands, provided that they be in good physical condition, and above all, contain a fair amount of humus. From what has been written about bananas in different countries it appears that they require a well drained loamy soil containing a fair amount of humus, and good amounts of potash, and phosphoric acid in readily available form.

With regard to the conservation of humus, a good deal is retained to the soil by the rotting of the stalks on the ground after the harvest.

(1) See also No. 248, B. March 1914.

(2) See also No. 1278, B. Sept. 1912.

been cut. The growing of green manure crops like velvet beans, Maudslayi beans, etc., is practised in some localities and can be strongly recommended.

Another cultivated plant exhausts the soil to such an extent as bananas. This is fully borne out by the following analyses carried out in the Queensland Departmental chemical laboratory, on virgin soil and exhausted banana land, both taken from Buderim Mountain, where the soil is a volcanic sandy loam.

	Virgin soil per cent.	Exhausted land per cent.
Humus and other organic matter	18.86	17.04
Nitrogen	0.560	0.292
Lime	0.450	0.180
Potash	0.109	0.067
Phosphoric acid, soluble in 1 per cent. citric acid	0.0142	0.0634

This is confirmed also by analyses, made in the same laboratory, of fruit and of different parts of the plant of three varieties of bananas. These show that a fair crop of Cavendish bananas (555 bunches per acre, of bunch 39 lbs.) removes in the fruit 123 lbs. of potash, $12\frac{1}{2}$ lbs. of phosphoric acid and 43.7 lbs. of nitrogen, whilst the stalks left on the ground contain 150 lbs. of potash, 6 lbs. of phosphoric acid and 41.4 lbs. of nitrogen. Calculating therefore 273 lbs. of potash, or about 5 cwt. of sulphate of potash per acre, must be available to the banana plant in a readily available form to produce its growth and crop in a few months.

In the manuring experiments conducted by the writer on Buderim Mountain, 160 lbs. of potash, 80 lbs. of phosphoric acid and 40 lbs. of nitrogen were applied to normal crops and in double quantities to the exhausted lands, the composition of which is given above.

The unmanured and lightly manured experiments showed the want of vigour in the plants; the banana sucker, as soon as the bunch appears, tends to lose its vitality; the leaves drop off and the stalk bends over and breaks under the weight of the small bunch. On the other hand the heavily manured plots produce good heavy bunches and the plants withstand better the cold weather during the winter.

In some cases very heavy manuring was tried, as much as two tons of artificial manure being given yearly, at a cost of £ 25 per acre, and, in the plots where lime was applied, attaining £ 29 per acre.

The average yield of the eight experimental plots (K P N, see Table) three years was 345 bunches with 3035 dozens of bananas per acre per annum, valued £ 38, the artificial fertiliser costing annually about £ 12 10s.

In the experiments 2 (K P N) the average yield was 457 bunches, with 40 dozens of a value of £ 54 per acre, showing an increased net profit over the yield obtained from the preceding plots.

These experiments further showed that nitrogen acts best in form of nitric acid and as nitrate of lime, that the addition of salt to the manure does not appear to make any appreciable difference, and that in the case of banana plantations it is best to apply part of the artificials in holes made

Crop Results of Manuring Experiments on Buderim Mountain.

Number of Experiment	Fertilizers Used	Average yield per acre	
		No. of bunches	Dresses
1	K P N b	156	1 34½
2	2 (K P N b)	243	1 90½
3	½ (K P N b)	132	7½
4	Nil	20	12½
5	½ (K P Nn)	216	1 51½
6	2 (K P Nn)	372	3 41½
7	K P Na	315	2 55½
8	K Pt Na	221	1 9½
9	2 (K P Na)	410	3 50½
10	K Pt Na	350	3 10½
11	2 (K P Nb)	388	3 20½
12	2 (K P Nn)	471	4 23½
13	2 (K P Nn) + salt	428	3 4½
14	2 (K P Nb) + salt	410	3 34½
15	Nil	273	1 76½
16	Nil + lime	323	2 16½
17	2 (K P Nn) + lime	388	3 32½
18	2 (K P Nb) + lime	421	3 53½
19	2 (K P Nn) + lime + salt	356	3 08½
20	2 (K P Nb) + lime + salt	374	2 98½

The figures of the first 10 experiments are averages of four years; those of the last 10 are averages of three years ending in 1914.

K = 160 lb. K_2O applied as 320 lb. potassium sulphate per acre.

Nb = 40 lb. N " " 290 lb. dried blood per acre.

Nn = 40 lb. N " " 290 lb. nitrate of lime per acre.

P = 40 lb. N " " 200 lb. ammonium sulphate per acre.

Pt = 80 lb. P_2O_5 " " 470 lb. superphosphates per acre.

2 (K P N) means double quantities; ½ (K P N) means half quantities.

All manures applied twice a year — in spring and autumn. Salt applied 2 cwt per acre; lime applied in two dressings of 2 tons per acre.

with a crow-bar to a depth from 18 to 24 in. all round the banana stool distance of from 3 to 5 feet, and the rest as top dressing. Lastly, it appears that physical conditions of the soil are improved by cultivation manuring.

In the close neighbourhood of the experimental plots other plots have been carried out some experiments which proved that manuring with i

potash yields disappointing results and that on virgin soil the application of the standard fertilizer mixture, K P N, gave the most profitable test, namely £62 2s. 3d. per acre. The table includes the results obtained by the writer. The literature mentioned in the paper mentions twelve works.

- **A New Oak for Breeders: *Quercus insignis*.** — *The Journal of Heredity*, vol. V, No. 9, pp. 406-407 + 1 plate. Washington, September 1914.

Dr. WILLIAM TRELEASE, of the University of Illinois, has called the attention of the American Genetic Association of Washington to *Quercus insignis*, and to the value it might have for hybridizing. The species in question was discovered in 1843 in the State of Vera Cruz, Mexico. It is found in considerable quantities about midway down the flanks of Mount Orizaba and especially near Chiapas. It is a rapid grower, attaining a height of 60 to 80 feet; its bearing is erect and it sends out large branches at a height of 30 or 40 feet from the ground. Its acorns are suitable as food for stock, and very large, usually two inches in diameter and sometimes more than a half. Their weight is 50 to 60 grams each. In view of its habitat the tree is probably unsuited to a temperate climate, but Dr. Purpus, who has explored its home, thinks that it could be introduced to Florida, Cuba, Porto Rico, etc. The office of Foreign Seed and Plant Introduction of the U. S. Department of Agriculture is now endeavouring to introduce it and experiment it. If it is found to be well adapted, it is probable that native species of oaks could be grafted with it, thus yielding a large crop of acorns. Hybridizing experiments should also be made with the local species with a view to obtaining larger acorns. Close relatives of *Q. insignis* are *Q. strombocarpa* of the same region and *Q. Skinneri* of Guatemala; the acorns of the latter, however, are remarkably bitter or astringent.

- **West Indian Boxwood.** — SPRAGUE, T. A., and BOODLE, L. A., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 214-219, London, 1914. By means of specimens of flowering and leafy twigs sent to Kew by the British Consul at Caracas, Venezuela, it has been possible to identify the West Indian or Venezuelan boxwood as *Casearia praecox* Griseb. According to information supplied by the same Consul, West Indian boxwood is a product of the district of Maracaibo only, whence all that exported to other ports is originally shipped. Boxwood is a yellowish hardwood, used mostly for turning. It is cut into pieces about 6 ft. long and from 4 to 8 inches thick. The best time for cutting the wood is from December to June. *Casearia praecox* Griseb. had hitherto been recorded only from Cuba; it has, however, been collected also in the district of Santa Marta, Colombia, under another name. The three forms (Cuban, Venezuelan and Colombian) differ so slightly in their characters and in the structure of their wood that they may be considered as varieties belonging to the same species.

There are also other species of *Casearia* which yield useful wood.

1133 - Experiments on the Grazing of Woodlands. — ZEDERBAUER, E., in *Abhandlungen aus dem forstlichen Versuchswesen Oesterreichs*, Part XXXVIII, pp. 7 Vienna, 1914.

By ministerial decree of March 30, 1888, the Royal Institute of Experimental Forestry established a scheme of experiments on the influence of pasturage on woods, planned to ascertain: *a*) the losses of intermediate and direct products caused by pasturage in 1) plantations of spruce, 2) natural growths of spruce; *b*) the nature and extent of the damage caused by grazing and trampling of animals; *c*) the measures to be taken to prevent damage to the wood, 1) of young trees transplanted and grown from seed, 2) of 3 and 4 year old trees from seed, 3) of 3 year old trees from seed, isolated, and in groups, 4) of 3 year old trees planted out in ordinary hedges and with a small hoed area round them; *d*) the most practical measures apart from fencing and hedging, of preventing damage by live stock to 1) isolated trees with and without supports, 2) trees in groups with and without supports, 3) plantations without artificial protection.

This scheme of experiments was carried out in State forests and also in private forests. The results are summarised in the following table.

The effect of live stock in plantations with or without protection.

Period	Trees without protection		Trees with protection	
	Number	Height metre.	Number	Height metre.
<i>a) Plantations with (1) and without (2) enclosure:</i>				
1 { May 1894	100	0.16	100	0.17
September 1909	12	1.55	61	1.62
2 { May 1893	100	0.25-0.30	100	0.15-0.2
October 1899	45	0.5-0.7	63	0.7-1.6
<i>b) Trees not transplanted and transplanted:</i>				
June 1900	100	—	100	—
September 1911	14	0.81	21	0.64
<i>c) Trees with (1) and without (2) supports:</i>				
1 { May 1894	100	—	100	—
September 1909	28	1.30	71	1.44
2 { June 1895	100	—	100	—
September 1911	13	0.77	38	1.15

These results show that: 1) spruce plantations enclosed or with supports made a stronger growth than those without this protection; 2) closed spruce plantations at 10 to 20 years contained about two-thirds

63 per cent) of the original plants, whilst plantations without enclosure only 12 to 45 per cent; 3) 20-year plantations of spruces protected by supports contain 38 to 71 per cent of the original trees, as against 3 to 16 per cent in plantations without supports; 4) 16-year stands of untransplanted spruces are less resistant to the movements of live stock than those of transplanted trees, while the differences in height are very slight; 5) the expenditure incurred in enclosing or providing supports appears to be justified from a forestry as well as financial point of view. Protection by means of supports is also an advantage to pasturage.

LIVE STOCK AND BREEDING.

The Hygienic Importance of Acid-Rennet Bacteria in the Udders of Cows.—GORINI, COSTANTINO (Communication to the VI International Dairy Congress, Berne, June 1914), in *La Clinica veterinaria, Rassegna di Polizia sanitaria e di Igiene*, XXXVII fasc. No. 17, pp. 47-51. Milan, September 1914.

In 1901 the writer showed the presence in the udders of cows, of acid-producing bacteria (cocci causing coagulation by means of acid and etc.) which are generally found in the lactiferous ducts. Later he found a very small bacillus forms, which he called *Bacillus minimus* n. sp.

These acid-rennet bacteria are capable of causing the premature coagulation of milk, *i. e.* before the normal acidity has developed, even immediately it is drawn from the udder and before external contamination. They develop exceptionally in the lactiferous ducts, being probably caused by the milk remaining in them after milking, and they cause inflammatory conditions of the udder or other complications. This inflammation differs from mastitis due to pyogenic or specific germs and usually appears spontaneously, though it is liable to affect the quality and quantity of the milk.

The changes in the milk due to these organisms are very different from those caused by other bacteria and cannot be detected either by acidimetric or by alcoholic methods, by boiling or by the reductase tests, etc. They are detected by zymoscopic or fermentation tests, which are also of great importance in judging the cheese-making value of a sample of milk and in detecting abnormal conditions of the udder.

The following practical conclusions may be drawn from these results:

- 1) To prevent the abnormal development of the acid-rennet micro-organisms in the udder it is advisable to ensure that the cow is milked dry so as to empty completely the lactiferous ducts.
- 2) In zymoscopic testing of milk, the type of coagulum produced by acid-producing bacteria may be used as a guide by both cheese-maker and veterinarian for indicating faulty milking and abnormal conditions of

the udder, which are as important to the health of the animal as to quality of the dairy products (1).

1135 - **Poisoning by *Sorghum halepense*** (2). — *Royal Botanic Gardens, Kew, B. of Miscellaneous Information*, No. 6, pp. 229-230. London, 1914.

Sorghum halepense is, after rice, probably the commonest food fodder plant in India, besides being much used elsewhere; yet the constituents which are liable to exert a poisonous action are not well understood. It has therefore been deemed desirable to publish a note dealing with matter.

In 1902 DUNSTAN and HENRY isolated a glucoside, which they call dhurrin, from the leaves of the great millet (*Sorghum vulgare*). This substance, on hydrolysis with hot hydrochloric acid or the enzyme emulsin, splits into prussic acid, parahydroxybenzaldehyde and dextrose. An enzyme emulsin is present in the parts of the plant containing the glucoside. *Sorghum halepense* Pers. (*Andropogon halepense* Brot.) is considered by Hackel to be a variety of *S. vulgare* Pers. (*Andropogon Sorghum* B.) and there is little doubt that dhurrin is found in it as well as in the type plant. The cases of poisoning observed are thus to be attributed to prussic acid produced by the hydrolysis of dhurrin in the stomachs of animals.

An examination of the numerous records of cases in which *Sorghum* was used as fodder, establishes two important facts: Firstly, the young vegetative parts of the plant are the most dangerous to stock, the mature plant being nearly or quite harmless; analyses of old plants have shown that little or no cyanogenetic substance was present. Secondly, the poisonous effect of the grass is enhanced in times of drought. One writer states that the grass is dangerous only in the green state and that when it is cut and dried and used for fodder it has no injurious effect. This may be due to the destruction of the glucoside or the emulsin or both, but it is possible that the grass was not cut till near maturity, that is at the disappearance of the glucoside.

1136 - **The Modifications produced in the Anthrax Bacterium by Means of Ultra-Violet Rays.** — Mme. VICTOR HENRI, in *Comptes Rendus hebdomadaires de l'Académie des Sciences*, Vol. 158, No. 14, pp. 1032-1035 (with 12 figs.); Vol. 159, No. 1, pp. 346-348 (with 6 figs.). Paris, April 6 and July 27, 1914.

It is well known that ultra-violet rays cause the death of micro-organisms. M. and Mme. VICTOR HENRI have demonstrated that the antibacterial effect of these rays is due to chemical reactions taking place in certain molecular aggregations which are to be found in the protoplasm, and especially in the cell nucleus. When the irradiation is weak, either in the case of numerous micro-organisms studied by M. and Mme. Henri or in that of developing *Ascaris* eggs studied by FAURÉ-FREMIET, a series of more or

(1) These conclusions, presented at the International Dairy Congress at Berne, June 1913, were adopted by the International Commission, which introduced zymoscopic testing for the study of the veterinary control of milk, in preference to all other tests (reductase, etc.) recommended for the laboratory control of milk. (Ed.)

(2) See also No. 1644, B. Dec. 1912, and No. 694, B. June 1913.

changes takes place. The fact that ultra-violet rays only attack the chemical constituents of the cells, leaving all the rest intact, led the writer to believe that by regulating the irradiation, it would be possible to induce modifications in micro-organisms.

The writer exposed to ultra-violet rays an emulsion of sporogenetic anthrax 24 hours old in quartz tubes revolving round a lamp for 1, 2, 3, 5, 10, and 40 minutes respectively, and then sowed 1 cc. on gelose and 1 cc. in broth. This treatment killed the greater number of the microbes, but some remained alive and capable of multiplying. A large number of the latter presented a normal aspect, but some colonies differed markedly. From these colonies, the writer has isolated a series of new forms distinct from the normal anthrax in morphological, biochemical and biological characters.

The character which is least stable under the action of the ultra-violet rays seems to be the uniting to form filaments. Further, the shape of the bacteria was changed (all forms being obtained, from bacilli to cocci), as well as their size (they became $\frac{1}{2}$ or $\frac{1}{3}$ the normal thickness), their sensibility to Gram's reagent (five forms being obtained which gave different reactions), and their pigmentation (two forms gave deep yellow cultures). While the morphological and biochemical modifications produced in cultures of bacteria grown in different media, e. g. in a medium containing serum, are unstable and revert to the normal form on being transplanted to a normal nutritive medium, the morphological and biochemical modifications due to exposure to ultra-violet rays are distinguished by their stability in successive artificial cultures.

On inoculating a guinea-pig with the modified form, the writer obtained no cases from cultures of the blood from the spleen and liver, corresponding with the characters of the normal anthrax bacteria. He therefore concludes that by passing into an animal organism the more modified, yellow, slender, Gram-negative form, which forms no spores, does not liquefy serum and has lost most of its virulence, can return almost to the primitive anthrax type.

Pyroplasmosis in Cattle in Hungary in 1913: Means of Control. — WOLLÁK, KÁROLY, in *Állatorvosi Lapok*, Year XXXVII, No. 33, pp. 387-389. Budapest, August 15, 1914.

In Hungary haemoglobinuria in cattle is relatively rare and seems to be restricted to the wooded regions of the North-East (1). Of late years, however, this disease has also appeared in the country on the left bank of the Tisza, where it sometimes takes a virulent form.

In 1913 pyroplasmosis appeared for the first time on May 20, in the commune of Hajduhadház (Hajdu county), and raged in a herd of 137 head of cattle which were grazing on some slightly elevated ground covered with oaks and robinias.

The writer describes the evolution of the disease and classes the symptoms observed into four groups according to the organs most affected. The bodies of the diseased animals, the greatest number of ticks was found

(Ed.)

(1) See No. 353, B. March 1914.

at the end of May, whilst towards the middle of June their number diminished and the disease also began to disappear. As the disease had run in a relatively short time, considerable losses (by June 1, 10 animals perished), in order to prevent its spreading, the writer subjected the 1 to examination and then to treatment. Of the remaining 127 head were still affected and 97 were apparently healthy. The herd was removed from the infected spot and the 30 affected animals were isolated and 1 in a stable; 7 among them were kept as controls and the others were rejected for ten days running to arsenical treatment. They were given every day, in a small ration of bran, the following mixture: 1 gm powdered arsenious acid; 10 gms. of powdered *calamus* root; 10 g of sulphate of iron. The bodies of the diseased animals were freed of ticks and the skin was washed with a 5 per cent creoline solution. After the first and second treatment it was observed that the animals gained their appetite; their urine presented its normal colour, and the weight of the animals perceptibly increased. The 23 animals under treatment were all cured, whilst among the 7 controls, 1 died and 2 had to be slaughtered.

In the herd which had been removed from the infected 25 animals fell ill. In two cows the disease took a rather mild form, with symptoms that the writer had never before observed in the symptomatology of pyroplasmosis. During the examination one of the cows to let itself fall on its knees and remained a length of time in position, while the other crossed its front legs; the disease appeared in these two cases under nervous forms, and as the urine emitted was not but of a deep yellow, the diagnosis was rendered more difficult. Arsenic also showed its beneficial effects. The useful action of arsenic observed in destroying parasitical protozoa (*Spirochaetes*, *Trypanosoma*) leads the writer to hope that this substance, in the form of powder, will be a valuable means of controlling pyroplasmosis, especially as arsenic acts favourably on metabolism and on the increase of weight. Further experiments will decide whether the use of the new arsenical preparation (salvarsan and neosalvarsan) can be practically recommended for cattle attacked by pyroplasmosis.

1138 - Preventive Inoculations against Sheep and Swine Pox. — Pécsi, Dániel, *Allatorvosi Lapok*, Year XXXVII, Nos. 30, 31, 32, pp. 337-359, 369-370, 381.

+ 2 figs Budapest, July 25, August 1 and 8, 1914.

The present is a study intended to afford Hungarian farmers information on sheep and swine pox (1) and on the means of controlling the disease. The writer mentions the works of numerous investigators who have sought to find a harmless virus which would ensure the active immunity of sheep. CHAUMIERS, VOIGT and others again have endeavoured to attenuate the activity of the variolous virus by passing it through an animal organism, so as to obtain a curative serum.

The writer, who has studied the question for the last 29 years, relates

(Ed.)

(1) See No. 536, B. June 1914.

experiments during 1913, made with virus attenuated by passing through calves, which have not given a definite result because calf-pox inoculated into sheep gave only 50 per cent. of immunity.

The study is completed by a report of a series of remarkable experiments by BRIDRÉ and BOQUET (1). Encouraged by the results of BESREDKA's discovery on the properties of sensibilised virus, they proceeded, by the application of this discovery, to modify the variolous virus in its activity by contact of a certain duration with anti-variolous serum, or in other words transform it, by sensibilising it, into vaccine. The experiments have given considerable results. The animals that were vaccinated with the sensibilised virus did not contract the disease and acquired in two to six days after the injection an absolute immunity. This immunity is very constant, and the vaccinated sheep did not prove at all dangerous to the untreated animals with which they were left in permanent contact. The injection must be made under the skin of the thorax behind the elbow; it causes generally, after four or six days, the formation of an oedema of variable size attaining sometimes that of a hen's egg, which is resorbed after a few days, leaving a hard spot which gradually disappears. The local reaction following on the subcutaneous injection of sensibilised virus varies in intensity according to the age of the animals. It is very slight in sucklings, more marked in lambs eight to ten months old and strongest in grown up sheep. Even when the local reaction fails, vaccination produces active immunity. In some especially sensitive animals, four or five days after the injection an increase of temperature sets in, which, however, is independent of the degree of local reactions. Vaccination does not cause any trouble in the physiological condition of the animals. Ewes in lamb or during lactation may be vaccinated without any danger of abortion or decrease of yield. Vaccination practised on sheep during the period of incubation of variola, has no unfavourable effect on the evolution of the disease. Calf-pox vaccination is thus applicable in contaminated surroundings, to apparently healthy subjects. The really sound animals will acquire immunity and those that are already infected will undergo the disease as usual. In 1913 in Algeria 1 245 000 sheep were treated with this serum and a single accident occurred.

MM. BRIDRÉ and BOQUET placed at the disposal of the writer a small quantity of sensibilised virus with which to experiment upon Hungarian sheep. The tests were made on ten lambs from four to six months old, of which two were kept as controls and the rest vaccinated as follows: two received the prescribed dose (0.2 cc); four were given half the dose and two a quarter; five days after vaccination all the vaccinated animals showed, at the spot where the injection had been made, oedema of different sizes. In one of the animals the temperature curve showed a maximum of 41.8° C.,

(1) Vaccination contre la clavelée par virus sensibilisé. — *Annales de l'Institut Pasteur*, No. 20, October 1913.

(2) De la vaccination par virus sensibilisé. — *Bull. de l'Institut Pasteur*, 1910, p. 241, p. 539.

whilst in the others it did not attain 41°C. The quantity of lymph used had no influence on the effect of the vaccination. The controls did not show any change, their temperature remaining unvaried at 39° C. Five days after vaccination all the animals were infected with pox; five days after infection the two controls presented, at the infected spot, an inflammation which developed after four days into a pustule the size of a pigeon's egg, while the animals vaccinated with the sensibilised virus remained perfectly immune. The spots caused by the infection had disappeared.

Sheep breeding has greatly benefited by the researches of M. M. BRUN and BOQUET, who have solved the vaccination problem: namely they have conferred an active, efficient and lasting immunity to sheep against the pox, by the inoculation of virus which is harmless to the animals inoculated and incapable of producing contagious lesions.

The writer warmly recommends the use of antipox serum, thanks to which sheep breeding in Hungary will be gradually freed from its greatest enemy.

1139 - Studies on Fowl Cholera: The Inheritance in Rabbits of Immunity to Infection with the Bacterium of Fowl Cholera. — HADLEY, PHILIP B., in *Agricultural Experiment Station of the Rhode Island State College, Bulletin* 157, pp. 282-294. Kingston, N. Y., April 1914.

The present paper is the writer's third contribution to the study of fowl cholera. In the first ("Fowl Cholera and Methods of Combating it" *Bulletin* 144, *Agricultural Experiment Station of the Rhode Island State College*) the writer announces the occurrence of the disease, — already known in Europe more than a century ago, — in the United States, especially in New England. Fowl cholera, caused by *Bacillus bipolaris septicus*, has been controlled by inoculations with serum, which, however, have not given uniform results. The writer obtained good preventive results by means of subcutaneous injections with from two to four cc. of 5 per cent carbolic acid, repeated daily for a week.

In the second work, prepared with the collaboration of ELIZABETH E. AMSON ("A Biological Study of Eleven Pathogenic Organisms from Cholera-like Diseases in Poultry", *ibid.*, *Bulletin* No. 146) the writers set forth the results of a biological study of eleven pathogenic organisms obtained from cholera-like diseases in poultry. The real fowl cholera caused by *Bact. bipolaris septicus* is endemic in New England and probably in all the central part of the Western States of the Union. There are, however, other diseases resembling fowl cholera caused by bacteria of the para-cholera, para-typhoid or influenza groups.

The writers studied ten cultures of *Bact. bipolaris septicus* obtained from localities very distant from each other, and they found that the bacteria were in all cases identical. The virulence of the cultures examined varied considerably: the minimum dose of 48 hours' broth culture fatal to a fowl varied from 10 cc. to a millionth of a cubic μ , and the minimum dose fatal to a rabbit from 10 cc. to one hundred millionth of a cubic μ . It was demonstrated that less than 50 bacteria, and probably only 4, injected

the muscles of the chest were sufficient to cause infection. One is to believe that in infected animals an immediate paralysis of the function of the phagocytes takes place, whence the terrible infectiousness under natural conditions. The bacterium resists four months' desiccation (the maximum limit is still undetermined); it is killed by heating to 63° C for 15 minutes; and it has very little resistance to carbolic acid and to acids in general.

A very virulent culture finds resistance in a susceptible animal when the animal has been previously inoculated with a homologous non-virulent culture. In rabbits, an artificial resistance to 10 billion times the minimum lethal dose of a highly virulent culture has been produced by a single strong injection of 3 cc. of the homologous culture. Only homologous cultures produced resistance in rabbits.

The third work is a continuation of the preceding ones and deals with the nature of the immunity in rabbits and the production of a corresponding immunity in fowls.

The writer gives a historical resumé of the inherited resistance to various diseases, from which he concludes: that immunity to certain infectious diseases, together with other phenomena dependent upon humoral factors of the blood, is transmissible from immune mothers to their offspring; that the immunity thus transmitted and acquired, is due in reality to the transmission of antibodies, is not inherited and transmitted by the mother and is not present in the second generation; that inherited resistance is of short duration, but that in some cases it can be transformed into active resistance by inoculating the young animals with a virulent culture. The cultures used in this study were the same as those employed in other investigations; they can be placed in two groups: the immunizing group and the infecting group. There has been found no morphological or cultural means of differentiating between the organisms of these two groups of cultures; the biological test alone serves to distinguish them. In the present research an immunizing (avirulent) culture was used. From experimental results the writer concludes:

Female rabbits immunized with an avirulent culture of fowl cholera bacterium are able to transmit to their offspring a high degree of resistance to virulent cultures. Some immune mothers are able to produce such immune offspring for at least more than two years after the date of immunization. Immunity is not transmitted by the immune male. The resistance in the offspring is not permanent, enduring for not more than forty days. This inherited passive resistance can be transformed into a durable, active resistance by inoculating the young animals, some time within the first forty days of life, with a virulent culture.

- 1140 - On Ovariectomy in Sows; with Observations on the Mammary Glands and Internal Genital Organs (1). --- MACKENZIE, K. J. J.; MARSHALL, F. H. A., and E. MOND, J. (School of Agriculture, Cambridge) in *The Journal of Agricultural Science*, Vol. IV, pp. 410-420; Vol. V, pp. 418-423; and Vol. VI, Part 2, pp. 182-186 (Cambridge, 1912, 1913 and 1914).

It is commonly found that the flesh of pigs killed "on heat" produces inferior bacon and pork, and the occurrence of animals in this condition in the slaughterhouses causes considerable losses to various bacon-curing firms. Of recent years, notwithstanding these losses to bacon manufacturers and pork butchers, the practice of spaying has been on the decline and in many pig-raising districts has largely disappeared, the reason being that pigs are now made ready for the butcher before they are nine months old and are consequently less affected while in the feeders' hands by neglect of the operation than when they are killed at a more advanced age so that breeders hesitate to expose them to the slight risk of the operation. Moreover, many feeders aver that they find some spayed sows which have like unoperated animals and consequently that the risk and slight expense are futile.

The writers examined three cases in which spayed sows were said to have behaved as if unspayed and found that in all three cases the operation had been incompletely performed, part of an ovary having been left behind in the body cavity and causing the undesirable symptoms in the bacon which consist chiefly in a greatly increased vascularisation in the mammary region and consequent depreciation of a valuable part of the pig. It would therefore appear that the objection to spaying on the grounds of its ineffectiveness put forward by feeders is without foundation, cases of failure being rather due to imperfect operations.

When examining carcasses in order to discard those of pigs killed on heat, bacon curers have been in the habit of regarding the presence of black melanic pigment in the deeper layers of the mammary tissues as due to extravasated blood and therefore a sign that the animal had been killed when on heat and that its carcass could not be used to produce bacon of an inferior grade. The writers examined a very large number of pigmented and unpigmented carcasses of both sexes and in various conditions with regard to their sexual organs; they obtained no evidence that the presence of the pigment was in any way associated with the sexual condition of the animal, but found that the pigment occurs only in certain dark-coloured animals. The remedy for this defect is to breed from animals in which the pigment is absent.

- 1141 - On Some Factors Controlling Fertility in Domestic Animals. --- HANCOCK, JOHN, in *The Journal of Agricultural Science*, Vol. VI, Part 3, pp. 263-277 + 2 pls (London, September 1914).

The fertility of domestic animals is a subject of ever increasing importance, for with the improvement of the breeds of live stock there has come in many cases lessened fertility and often sterility. Thus, in Great

tain the Royal Commission on horse breeding found that about per cent of the mares selected for breeding failed to produce foals.

PEARL has recently shown that the variation in fecundity (eggs produced) in various breeds of the common fowl is not anatomical; that a sterile strain of fowls does not necessarily contain more oocytes in the ovary than an infertile strain. He concluded that the fecundity of fowls depends on a physiological factor causing the oocytes to develop and grow. In mammals it is known that many oocytes atrophy at some stage of their development, but this has not yet been described in the common fowl. HEAPE and MARSHALL, who investigated the fertility of sheep, came to the conclusion that several factors influenced the number of ova shed during the heat period: among others, service early in the breeding season and the practice of "flushing", which seem to favour the ripening of the oocytes and prevent atrophy of the follicles. Nevertheless, some facts could not be explained as a simple result of the number of follicles which ripened, for instance the fact that in-breeding reduces fecundity while out crossing increases it, as has been observed by HEAPE in sheep, by DARWIN in pigs, RITZEMA-BOS in rats, and by VON GUAITA in mice.

Since ovulation occurs spontaneously in the pig and is not influenced by copulation, the diminution of fertility on in-breeding must be due to other causes than the number of follicles rupturing at the heat periods. HEAPE suggested that in sheep the decreased fertility when in-bred might be due to some sort of abortion. STEPHENSON attributed many cases of sterility to the male, owing to a want of vitality, varying in degree, in the gametozoöa, which prevents the ovum or foetus reaching maturity and thus results in abortion.

The writer has endeavoured to determine the factors controlling the number of young produced at birth by counting the number of corpora lutea and foetuses in pregnant animals at various stages of gestation. The animals observed were rabbits, pigs and a bitch. The writer divides the factors controlling fertility into two groups:

1. Factors controlling the number of ova shed (fecundity, of the female).
2. Factors controlling the number of embryos which develop to full maturity.

1. *Factors controlling the number of ova shed.*

In all probability it is as regards this factor that species and factors vary in the matter of fertility. It seems to be a complicated physiological factor which can be modified to a certain extent by improving the nutrition of the ovary. PEARL observed that the greatest egg production in fowls is in the first year; in general, fertility increases with age up to a certain point, after which it falls gradually. It is well known that the number of young produced by a young animal breeding for the first time is below normal. MINOR has observed this fact with guinea-pigs, P. G. BAILEY with rabbits, WALLACE with sows. The writer has observed in 18 young sows that the number of corpora lutea varied from 11 to 19 and averaged 15 ± 0.39 , whilst in 9 old sows it ranged from 13 to 24 and averaged

19.77 ± 1.26 . It appears therefore that the lower fertility of you sows is due to a smaller number of ova being shed.

2. *Factors controlling the number of embryos which develop to re maturity.* — The writer counted the *corpora lutea* in the ovaries and the number of foetuses in the uterus of pregnant sows, rabbits and a bitch, and found that the average number of ova shed at a heat is larger than that of the foetuses. In sows the number of ova was twenty, while the average litter of pigs is about twelve. In American breeds it appears to be less: in Duroc Jerseys 9, and in Poland-Chinas 7.5. In rabbits the average number of *corpora lutea* was found to vary from 8.4 to 11, and the corresponding number of foetuses from 6.4 to 8.1. Of some of the ova shed at the time of conception no trace can be found in the uterus; it is supposed they may be lost by wandering into the body cavity instead of being caught by the Fallopian tubes. This, however, could not occur in the Carnivora, where the fimbriated end of the Fallopian tube completely surrounds the ovary. In the bitch examined by the writer the number of foetuses and *corpora lutea* were the same, namely five.

There is also the possibility that some of the ova may have escaped fertilization; or rather that they have been atrophized at a very early stage of development of the embryo, so as to leave no trace of their implantation.

Other ova shed from the ovary, although developing to a certain extent, never come to maturity and atrophy in the uterus.

The writer has found in sows and rabbits, and other observers have found in cows, sheep, hamsters and ferrets, that the pregnant uterus often contains besides the normally developed foetuses, a few smaller ones in different degrees of development and in various stages of degeneration. Of seven sows observed by the writer, four contained atrophic foetuses with an average of 2.1 for the seven sows. Of 38 rabbits, 11 contained atrophic foetuses.

In animals bearing many young at birth this atrophy of the fertilized ovum is not very important economically, since, as a rule, many more ova are shed than would furnish foetuses to occupy the teats of the mammary gland. In animals producing only one or two young at a birth (males and cows), however, the matter becomes one of great importance, for in these animals cases of complete sterility are frequent.

The cause of atrophic foetuses is not bacterial, since normal and atrophied foetuses are often found side by side; besides, the writer in his search for bacteria in the atrophic foetuses and in their membranes obtained only negative results.

The nutrition of the pregnant mother cannot be the cause of atrophy, though in many cases it affects the size and vigour of the new-born. From measurements made by the writer it appears that on the whole the larger the foetal membranes in pigs the larger the foetus. No connection has been found to exist (in pigs and rabbits) between the weight of the foetus and its position in the uterus; consequently competitive nutrition has very little effect in determining the size of the foetus. Fraenkel has shown that the nutrition of the foetus is more especially under the control of the *corpus luteum*.

From an examination of the works of several investigators, it seems probable that the atrophy is due to the low vitality of the foetus owing to constitutional loss of vigour of either parent at the time of mating, or to insufficient vitality in the spermatozoa, or to domestication (the writer observed that in wild rabbits atrophic foetuses are much rarer than in domestic rabbits). It seems that the effect of domestication on these animals is to increase the number of ova shed and at the same time to diminish the proportion of those which develop.

The writer does not arrive at any definitive conclusion on the cause of the atrophy, and the several possibilities suggested are still under investigation.

42 - **Research on the Transformation of Energy in the Domestic Fowl.**—GERHARTZ, HENRICH, in *Landwirtschaftliche Jahrbücher*, Vol. 46, Part 5, pp. 797-814. Berlin, July 14, 1914.

The most important investigations hitherto made by VÖLTZ, LEHMANN, BRATTSCHUCK, RICHET, REGNAULT-REISET and others, on the transformation of energy in the domestic fowl, as well as in birds in general, are now no longer sufficient, as they do not correspond to modern demands upon the technique of observation and do not give due weight to the biological activity of the animals. The writer, with the assistance of the Prussian Ministry of Agriculture, undertook several experiments on this subject. They were carried out with an improved system of Regnault-Reiset's apparatus, in which the bird was in a state of repose throughout almost all the experiments and could be observed without being disturbed. The writer experimented with fasting birds and birds that had been fed. In the first case the bird was not given any food during the 13 hours which preceded its being put into the respiratory apparatus. In the second case the bird usually ate its food during the preliminary experiment. The ration was calculated to keep the weight of the body constant. When the bird was not in the respiratory apparatus it was kept in a roomy cage.

The object of the first experiments was to observe the quantity of energy transformed in the fowl when it was in a state of absolute repose and consumed only so much matter as was necessary to keep up its physiological activity. This transformation of energy is called by the writer the "minimum" or "upkeep transformation", and it amounted to 58.37 calories for a normal fasting fowl and 62.15 calories for the same bird that had been fed per day and per unit of surface (1000 square centimetres). In the brooding hen of the same breed after feeding, the corresponding figure was 71.78 calories. On comparing these values with those of Zuntz for dogs (75.1) and for horses (94.8), it appears that fowls in a state of absolute repose have a relatively high transformation of energy, but a relatively low one. An abnormally high transformation in birds is thus quite out of the question. The next experiments were aimed at ascertaining how, and to what extent, the organs of reproduction and their functions acted on the minimum transformation. With this object experiments were made during the moulting and the brooding periods. They showed that during the moulting

period the transformation was slightly increased, namely by 5.2 per cent while the brooding period did not cause any change.

In a third series of experiments the writer endeavoured to determine whether the laying period, exclusive of the amount of energy required for the formation of the egg, had a specific action on the transformation. With this aim experiments were made before and after the laying period. If there was a specific surplus of energy beyond that required for the formation of the egg, it ought to be noticeable in the period of transition. The experiments showed that the transformation of energy went on increasing even after the period of egg-laying, which can only be explained by admitting a specific effect of the period of laying on the transformation of energy. Eight days before laying the first egg, as another experiment showed, this effect was not yet noticeable.

A last series of experiments was devoted to determining the influence of the function of egg-laying on the transformation of energy in the hen. With this object several tests were made. Of these the first group led to the following results. The period of egg-laying caused an increase of calories in the transformation of energy, or 78 per cent per unit of surface per day. Each day 43.9 calories, or 26.2 per unit of surface, were employed for the formation of the egg. Admitting that the period of egg-laying itself, without considering the outlay of energy directly caused by the formation and expulsion of the egg, increases the transformation of energy about 35 per cent (experimental results of successive periods), there will always remain $78 \text{ per cent} - 35 \text{ per cent} = 43 \text{ per cent}$ for the formation of the egg and egg-laying proper.

In the second group of experiments on the egg-laying period, results differed somewhat, for instead of the 26.2 calories per day and unit of surface, 24.8 calories were utilized in the formation of the egg.

The figures obtained in these investigations are interesting also from another point of view. If, as has been stated above, 26.2 calories are consumed for the formation of the egg, 10.8 correspond to the protein and 15.4 to the fat. The fixation of these two substances requires, however, different contributions of energy. Admitting, with KLEIN and VON DER HART, that for the formation of 1 gram of protein 7.25 calories are required, and for 1 gram of fat 2.5 calories, the fixation of the protein would have required 13.8 calories and that of the fat 4.1, thus altogether 17.9. But the period of egg-laying caused an increase of 70.1 calories in the transformation of energy. There remains therefore a surplus of $70.1 - 17.9 = 52.2$ calories. Taking the specific influence of the laying period at 24.5 calories (that is, $26.2 - 1.7$), there remains a difference of energy of $52.2 - 24.5 = 27.7$ calories, corresponding especially to the formation of the egg above the expense of energy required for the formation of flesh. The formation of the egg in the hen is thus accompanied by a considerable expenditure of energy.

The Preparation of Ensilage. — SAMARANI, FRANCO, in *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Year 13, Nos. 8-12, pp. 87-103. Rome, August-December, 1913.

The results of the experiments carried out for many years by the writer the purpose of discovering the best method of preparing ensilage in ordinary silos have shown that during the first few days after the grass has been put in, two typical and different fermentation processes take place at the expense of the sugar and of the cell-sap — an acetic fermentation and a lactic fermentation.

The first is an intracellular process, through which the sugars of the plant substance are transformed, as a result of the vital activities of the cell, in a relatively warm place (silo) where there is an almost complete absence of oxygen, into alcohol and carbonic acid. Later, as a result of chemical or physiological, but certainly not bacterial, action the alcohol is transformed into acetic acid. The second process is an ordinary lactic acid fermentation, due to the action of bacilli and cocci such as are found in milk and milk products. Of the total free acid content of normal acid silage, on an average 70 per cent is acetic acid, up to 20 per cent lactic acid, and, highly speaking, 10 per cent butyric acid.

The predominance of the acetic acid is chiefly due to the fact that the temperature of the silo rises to 40-60° C, which is particularly favourable for intracellular fermentation. If, however, the lactic fermentation has free scope at its disposal, it can, owing to its power of acting directly on the latter, produce more acid than the acetic fermentation, which can only transform sugar into acid indirectly. When in the acid ensilage efficient lactic and acetic acids have been produced, which takes place a few days after the filling and pressing down of the silo, no further bacterial fermentation goes on. If sufficient acidity is not soon attained by the two fermentation processes, a putrefactive fermentation sets up, with formation of ammonia, butyric acid and other malodorous compounds. Unstable fermentation, from the experience of the writer, is best prevented by the addition to the silage of a dilute solution of milk sugar.

From these observations, the conclusion can be drawn that in order to succeed in making ensilage, it is above all necessary to avoid overheating the fodder, in order to limit the acetic fermentation and thus to leave the decomposition of the sugar chiefly to the lactic fermentation process. This end can best be attained by providing the silo with mechanical means of applying pressure. The experiments of the writer in this direction showed that mechanical pressure is best applied immediately after the required amount of fodder has been put in, so as by this means to free the silage as much as possible from air. When the interior of the silo is once free of air, the temperature rises with difficulty and the lactic fermentation is promoted at the expense of the acetic fermentation.

According to observations made by the writer, silos with mechanical presses yield a fodder with 70 per cent lactic acid and 20 per cent acetic acid, while the proportion is just reversed in the product of an ordinary silo. Further, they have the additional advantage of producing ensilage containing less free acid and which consequently smells less strongly.

In conclusion, the writer gives some information respecting an ensilage experiment with beet slices straight from the sugar factory. He holds that in order to obtain a satisfactory product, it was necessary to remove all the air from the silo. This was of course best effected by heavy pressure.

In order to promote lactic fermentation, Sig. Samarani advises as in the treatment of grass, the addition to the silage of a solution of sugar.

1144 - The Forage Value of Redshank (*Polygonum lapathifolium*).

STÖRME and KLEIN, in *Deutsche Landwirtschaftliche Presse*, Year 41, No. 80, p. 1 Berlin, October 7, 1914.

Redshank (*Polygonum lapathifolium*) was used by many farmers as fodder in Germany during 1914. Its chemical composition is, according to a recent analysis made at the Köslin Experiment Station, as follows:

Water	71.74 per cent.
Dry matter :	
Ash	2.29 per cent.
Crude fat	0.69 "
Crude protein	3.07 "
Crude fibre	8.08 "
Nitrogen-free extract	14.03 "
	28.16 "
	99.90 per cent.

The digestible substances are :

Crude protein	1.72 per cent.
Pure protein	1.25 "
Fat	0.35 "
Crude fibre	4.70 "
Carbohydrates	9.35 "
	17.37 per cent.

According to the above analysis, the food value of redshank is equal to that of pasture grasses such as rye-grass and cocksfoot.

All practical farmers agree in stating that redshank has given complete satisfaction as fodder and that it has not caused the slightest injury to the health of the animals. As food for milch-cows it has also been used. The writer believes that in years of scarcity of forage it will prove a welcome addition to the food supply.

1145 - The Influence of Temperature on the Microflora of Hay: Lactic and Butyric Hays. — GORINI, C., in *Rendiconti della R. Accademia dei Lincei*, Vol. XXIII, Ser. Part 1, No. 12, Rome, 1914.

Applying the methods of silo research (1) to hay, it has been possible to determine a main difference between normal and abnormal hay. The hays are to be called normal which have not undergone abnormal maceration or fermentation, nor become mouldy, scorched or damaged. Normal hays are divided into normal lactic and butyric hays according to the nature of the predominating fermentation.

(1) See No. 541, B. June 1914.

The writer submitted the same hay stack during its various stages of fermentation to zymoscopic and bacteriological examination. He found that during the first 3 to 5 days of fermentation, with a temperature of 50-55° C., the hay was prevalingly lactic, whilst as the temperature gradually rose to 60-65° C. and beyond, the mass tended to become more butyric, is unfortunately often the case in ordinary stacks.

The results confirm those obtained in the case of silos:

1) Normal hay may be classified as lactic or butyric according to the predominating microflora.

2) The nature of the microflora is in direct relation to the temperature of fermentation.

3) Most hay, as in the case of ordinary silage, is of the butyric type and consequently less favourable to the intestinal functions of the live stock and to the sanitary condition of the milk and its products.

4) To obtain lactic hay, care should be taken in stacking it to expel as much air as possible and to maintain a temperature of about 50° C.

These conclusions show the importance of zymoscopic-bacteriological control of fodder in order to estimate its value as forage from a sanitary and dairy point of view. Thus a normal hay may as a result of zymoscopic, chemical or simple microscopic examination be declared healthy and yet contain a microflora dangerous to the intestinal functions and health of stock and consequently to the quality of the milk and dairy products.

6 - **The Food Value of *Stizolobium aterrimum* and *S. pachylobium* Beans.** — SHREWSBURY, HERBERT S., in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XIII, No. 81, pp. 194-195; and No. 82, pp. 240-241. Port-of-Spain, June and July, 1914.

The seeds of the two species of *Stizolobium* grown on the same estate Trinidad, in the same seasons, were recently submitted to the Department with a request for information as to their suitability for fodder.

Their nutritive value is shown by the accompanying table; it is very nearly the same for both species, but *S. pachylobium* is somewhat preferable because it has larger seeds and consequently a lesser proportion of gums and indigestible crude fibre.

Feeding experiments on guinea-pigs showed it to be highly improbable that the beans were toxic in the slightest degree.

On analysis no poisonous glucosides, saponins, fats, alkaloids, vegetable ptomaines or toxalbumins were found. Besides, the beans of *S. pachylobium* have been used as fodder and also for human food without ill effects. It does not appear, however, that *S. aterrimum* has ever been used, in Barbados, as fodder or as human food, while the leaves are said to have poisoned cattle. It is not yet quite certain that *S. aterrimum* is not a synonym for *S. utile* or *Mucuna utilis* of Wallich, which has been cultivated extensively in Mauritius and Tasmania as a table vegetable and as a fodder for cattle.

In the accompanying table the composition of soy beans is also given for comparison. The two *Stizolobium* are inferior in feeding value

to soy beans, but they are somewhat superior to French, Lima or beans.

	Carbo- hydrates	Proteins	Water	Crude fibre	Ash	Fat	Fe- tu
<i>S. aterrimum</i>	44.3	29.8	12.0	6.2	4.2	3.5	1
<i>S. pachylobium</i>	47.2	29.2	11.0	4.1	4.2	4.3	1
<i>Soja hispida</i>	39.2	33.2	10.0	4.4	4.7	17.5	1

1147 - **Statistics of British Feeding Trials and the Starch Equivalent Theory**
WOOD, T. B., and YULE, UDRY G. (School of Agriculture, Cambridge) in *The Journal of Agricultural Science*, Vol. VI, Part 2, pp. 233-251. Cambridge, May 1914.

Summaries of about 400 feeding trials (200 dealing with oxen and with sheep) were compiled from reports of British experiments carried out down to 1907 and were published in the *Journal of the Highland Agricultural Society* for 1909-1910. The present paper makes a statistical examination of these summaries for the purpose of investigating the reason why British experimenters, calculating on the basis of Kellner's figure usually find that the increases produced by various diets are not proportional to the excess of starch equivalent provided by the diets above that required for maintenance.

Swedes were the first to be investigated in this connection, as they represent an article of food used to a much larger extent in Great Britain than on the continent, and it seemed quite possible that Kellner's figure for starch equivalents in roots, which are based on a small number of experiments, are not accurate when roots are used in such large amounts as is usual in British farming. All experiments dealing with the feeding of swedes to oxen were abstracted from the summaries, and, after deducting the food required for maintenance from the other constituents of the diets as far as possible, the results of feeding swedes were obtained in terms of increase as follows:

Corrected weight of swedes in ration above maintenance, per 1000 lbs. live weight per day	Number of experiments	Average live weight increase produced per 1000 lbs. live weight per day	Probable error of average
lbs.		lbs.	
40 to 60	3	1.46	—
60 " 80	4	1.73	—
80 " 100	14	1.72	0.082
100 " 120	17	1.83	0.061
120 " 140	13	1.93	0.078
140 " 160	8	1.85	0.048
over 160	3	2.39	—

Now assuming that the increase consists of 67 per cent. of fat and per cent. of water (LAWES and GILBERT) and that 1 gm. of starch equivalent yields 3.76 calories in the animal and 1 gm. of fat 8.8 calories, the following rough approximation to the percentage utilisation is obtained for swedes used in varying quantities above maintenance:

Corrected weight of swedes in ration above maintenance, per 1000 lbs. live weight per day	Percentage utilisation
— lbs.	—
50	51
70	43
90	33
110	29
130	26
150	21

The figures receive some support from the fact that Kellner's average figure for percentage utilization is 50 per cent. which is about the same as the utilisation of swedes in the British trials when used in small quantities. They also agree with figures directly determined in the winter of 1913-1914, when two lots of 10 oxen of similar weights were fed on just sufficient hay and chaff to supply maintenance, the one lot receiving in addition 150 lbs. of swedes, the other 138 lbs. In the former case the percentage utilization was 47; in the latter it fell to 32. In the experiments on which Kellner based his starch equivalents, the amounts of food added to the basal ration varied very considerably, yet there is always direct proportionality over a wide range of diet between the excess of food above that required for maintenance and the amount of increase produced, and in all cases approximately 50 per cent. of the excess of food expressed as calories above maintenance requirements was utilized as increase in live weight.

The next step was to recalculate the results of all the experiments given in the above-mentioned summaries in order to determine their percentage utilization. The new results were as follows:

Lbs. starch equivalent above maintenance: oxen per day sheep per week	Percentage utilisation	
	Oxen	Sheep
3-4	—	58 ± 5
4-5	—	48 ± 5
5-6	—	56 ± 3
6-7	39 ± 2	48 ± 2
7-8	35 ± 2	46 ± 2
8-9	34 ± 1	37 ± 2
9-10	32 ± 1	37 ± 2
10-11	30 ± 2	42 ± 2
11-12	26 ± 2	—
12-13	24 ± 1	—
13-14	21 ± 1	—

These figures agree with those given above for the utilization of swedes the larger the amount of food above the maintenance ration, the smaller the proportion utilized, yet the figures are comparable with Kellner's at any rate as regards range of diet. The difference between the two sets of results make it clear why British experimenters do not obtain results in the feeding trials which agree with Kellner's starch equivalent theory: Kellner's starch equivalents are based on figures which indicate a direct proportionality between the amount of food consumed above the maintenance ration and the live weight increase produced, while British feeding trials indicate clearly and with certainty that the percentage utilization of food decreases as the diet is increased, each successive increase giving a smaller return in live weight increase than the last.

As a possible explanation of the divergence between Kellner's and British experience, the probable errors of the results were worked out and removed all doubt as to the significance of the differences observed. Another possibility was that whilst Kellner's figures are based on experiments in a respiration chamber, in which the carbon fixed in the form of increased weight was accurately determined by means of a carbon balance, the British results were obtained in ordinary feeding trials in which the utilization is calculated from the increase in live weight by a factor depending on a very small number of experiments carried out at Rothamsted many years ago. This factor may be assumed to give the proportion of fat in the total increase of weight as a lean animal becomes fat, but it may fail to give with accuracy the proportion of fat in successive increases as the animal slowly fattens from the lean condition. There is some evidence to show that the first addition of live weight increase to a lean animal may contain as much as 50 per cent. of water and only 50 per cent. of fat, whilst the last additions of weight to the animals may be almost entirely fat. In the case of the oxen this would increase the lowest utilization with the highest diet from 21 per cent. to 31.5 per cent., which is still significantly below the highest percentage utilization of 39 per cent. and much lower than Kellner's average figure of 50 per cent.

A further reason for divergence might lie in the fact that whilst Kellner's experiments were confined to the measurement of the carbon balance for a short period including the formation of only a few pounds of fat the period of the British experiments was some four or five months, during which the animals laid on several hundredweights of live weight increase; it is quite possible that there might be a direct proportionality between food and increase in the early stages of fattening whilst the animal is still comparatively lean. Accordingly all the experiments with oxen were classified according to the period of feeding and their percentage utilization was worked out as follows:

Length of experiments in days	Percentage utilization
20 to 80	32
80 " 100	31
100 " 120	33
120 " 180	32

Evidently the length of time of the experiment has on the average no effect on the percentage utilization of food, the reason of this probably being that in some of the shorter experiments animals already half fat were used, and under these circumstances, the length of the experiment was not a measure of the extent to which the fattening process was pushed. The question was therefore attacked by calculating the percentage utilization during the various stages of fattening in a separate series of trials, the detailed data of which were available. The results are given below.

	Percentage utilization
1st month	39
2nd "	34
3rd "	31
4th "	15

The average utilization is very good during the first month and does not fall off much during the second and third months, but in the fourth month the falling-off is very striking indeed. It would therefore appear that whilst Kellner's starch equivalents may give a fairly accurate measure of the amount of fat production to be expected from various foods in the early stages of fattening, they fail to do so in the later stages, because as fattening approaches completion, the law of diminishing returns asserts itself and a given amount of starch equivalent produces less and less fat as fattening goes on and the animal gets ripe. Kellner's starch equivalents, too, when very liberal diets are used, because here the animal very quickly reaches that stage of fatness at which the law of diminishing returns begins to make itself felt.

The writers point out the remarkable variation in efficiency, as fat-producing machines, among animals of the same breed fed under identical conditions and show that the standard deviation under these conditions is 21 per cent. of the live weight increase and the probable error in the increase of weight 14 per cent. Calculating on this basis, average-sized animals on average rations having a heat value of 25 400 calories would retain 6 400 cal. to 8 400 cal. in their bodies and give out heat amounting to 19 000 and 17 000 cal. respectively. Examination of the increase in individual oxen shows that, assuming that similar amounts of food are consumed, the differences between the amounts of heat evolved are even greater than those indicated above and may reach 25 per cent. between the farmer would call a good and bad "doer". Investigations are now in progress at Cambridge on the variation of digestibility according to the individual peculiarities of the animal and the amount of diet, and on the possibility of estimating the rate of heat evolution from animals known fattening capacity by measuring the difference between their body temperatures and the temperature of the surrounding air.

1148 - **Feeding Experiments with Whole Milk and Skimmed Milk with Cre Substitutes** (1). — WELLMANN. — Reprint from *Landwirtschaftlichen Jahrbuch* pp. 499-526. Berlin, 1914.

The writer made comparative experiments on the utilization of whole milk and of skimmed milk with cream substitutes for feeding calves and young pigs.

The fresh whole milk of the day was pasteurized for a quarter of an hour, then cooled and kept in a cool place in well closed cans.

The additions to the skimmed milk consisted of meal and of flour starch saccharified by diafarine (a preparation of diastase); it was also homogenized with a preparation of tallow known in trade under the name "Premier jus".

The skimmed milk with meal was prepared as follows: the daily fresh skimmed milk was passed through a sieve and pasteurized; while still warm it received the addition of 54 parts of wheat meal, 27 of rye meal and 1 of common salt per 1000 parts by weight of liquid. The mixture was passed a second time through a fine sieve and then kept in a well closed vessel.

The diafarine skimmed milk was prepared in the following manner. After being passed through a sieve and pasteurized it was cooled to 55-60° and mixed with 50 parts by weight of wheat meal, 25 parts of rye meal and 7.5 of diafarine per 1000 parts of liquid.

In another experiment skimmed and whole milk were mixed and this mixture (containing 2.5 per cent of fat), 50 parts of wheat meal and 25 of rye meal per 1000 were added, together with 7.5 parts of diafarine with the object of saccharifying the meal starch. This preparation called by the writer "Diafarin-Fettmilch".

The homogenized milk was prepared by mixing the tallow preparation intimately with skimmed milk.

Eleven pigs from two to four weeks old were experimented upon; two of these were slaughtered at the beginning of the experiment as controls, the others at the end. The milk was always given *ad lib.*

The experiment showed that from a dietetic point of view whole milk, diafarine milk, and skimmed milk with meal gave the best results; intestinal troubles occurred with the use of these feeds. The animals seemed to relish most of all the diafarine milk. The homogenized milk was always willingly taken, but one animal fed on it had an attack of scours which was soon arrested by some citric acid.

The digestibility of the various milks was, on the whole, the same even when that of the individual foods was different. The high digestibility of the fat in the homogenized milk was striking; although there was 6 per cent of fat it was utilized even better than in the whole milk. Protein proved more digestible in the milk with wider albuminoid ratio (from

(1) See also the original articles: 1) Prof. PAUL SCHUPPLI, *Calves Rearing on the Bernese System*, B. Feb. 1913, pp. 167-173; and 2) Prof. ANTONIO PROCCITT, *Utilization of Skimmed Milk as Food for Calves*, B. Aug. 1913, pp. 1157-1164. (Ed.)

ized milk) than in that with a narrower ratio (whole milk, diafarine-skimmed milk). In most cases the young pigs utilized the milk better they grew older.

The greatest assimilation of nutritive matter per 1000 of live-weight observed with diafarine-skimmed milk (35.93), and "diafarin-fett milch" (38.5), and meal and skimmed milk (45.53). With whole milk the corresponding figure was only 30, and with homogenized milk 30.47. The consumption of starch values the difference between the four kinds of milk was barely 15 or 20 per cent.

The daily increase per 100 lbs. of live-weight ranged from 2.2 to 3.5, and diminished with increasing age. It varied from 3.08 to 3.34 lbs. with whole and homogenized milk; it was 3.25 lbs. for diafarine-skimmed milk and 3.5 lbs. for "diafarin-fett milch". The pigs retained in their flesh from 36 to 74 per cent. of the digestible nitrogen supplied.

From an economical point of view, diafarine skimmed milk was the most satisfactory and "diafarin-fett milch" the least.

The cost of one pound of gain varied with the different feeds as follows

	d
Whole milk	7.11
Diafarine-skimmed milk	3.10
Meal-skimmed milk	3.53
Diafarin-fett milch	7.80
Homogenized milk	4.65

Thus, feeding with diafarine-skimmed milk costs about one-half, and with homogenized milk about two-thirds of the expense of feeding with whole milk.

In the pigs fed on diafarin the flesh was singularly light coloured.

The paper contains data on the weights of the different organs of the pigs and on the analysis of the flesh.

99 - **The Breeds of Horses of the Sunda Archipelago.** - VON BARNEKOW, HANS, in *Zeitschrift für Gestiückunde und Pferdezucht*, Year 9, Part 9, pp. 194-198. Hanover, September 1914.

This paper is a brief review of the most important breeds of horses of the Sunda Archipelago, namely, Sandalwood, Macassar, Sumbawa, Savanese, Timor, Batak, Boverlander, Java and Preanger.

The Sandalwood horse is a native of Soemba island and is considered the whole as the best of the archipelago. For scores of years it has been exported in numbers to Java, consequently the stock has diminished to such an extent that measures had to be taken for the preservation of the breed. Its body is compact and is supported by sound and strong feet, that the horse is especially suited for the saddle. The strong strain of Arab blood with which it has been credited can no longer be recognized it owing to long-continued inbreeding. The Sandalwood has a very regular pace and is an excellent trotter. It combines a lively fiery temperament with great good nature. Its coat varies, but jet black, dark brown and piebald are the commonest.

The *Macassar* breed found in Celebes is the one that approaches the Sandalwood. It is smaller and not so handsome, but its frame is stronger, it is more resistant and thriftier and it is much appreciated as a cavalry horse. It is bred by the natives, who are distinguished above all the other Malays for their skill in breeding. Nevertheless this breed is threatened, more than any other breed, with extinction, as hitherto neither the Government nor the leading breeders have been able to combat the destructive disease known locally as "Niewe Ziekte".

The third breed of the Sunda Archipelago is that of the *Sumbawa* horses, from the island of the same name. They are decidedly draught horses and possess powerful limbs with clean bones and sound hoofs. They are smaller than the preceding breeds and combine a good nature with extraordinary resistance, which renders them very suitable for artillery. At present Sumbawans are the most numerous breed in the islands. Their exportation ranges between 8000 and 10 000 head per annum. The dread Tambora disease, a consequence of shortage of forage and of draught, has never sensibly diminished the stock of Sumbawa horses.

The next breed allied to the Sumbawans is the *Bimanese*; it is a native of the same island and is chiefly used for the pack saddle.

A special breed is the *Savonese* from the island Savoe. The horses of this breed are not very numerous; they are the result of a cross with Sandalwood and, like the allied Rottinese breed, are fast carriage horses; they are much esteemed and exported to Java and Celebes.

The *Timor* breed, from the island of Timor, is really a diminutive Sandalwood. It was once held in great repute, but continuous inbreeding has so deteriorated it that its exportation has greatly diminished. Endeavours are now being made to restore this excellent breed to its original high level.

A horse that outwardly much resembles the Sandalwood is the *Batak*, which for its usefulness is superior to all the other breeds. Its real home is the high plateau of Sumatra, and especially the shores of the great Toba lake. Its conformation is handsomer than that of any other breed and renders it as suitable for the saddle as for draught. Batak horses are in great demand on the tobacco plantations of British India, Singapore, Malacca and Penang.

The collective name of *Bovenland* horses is given to all the other breeds of the west coast of Sumatra. They differ a good deal in build and usefulness from each other; they are heavier than the preceding breeds and do not equal them in general utility. Many fine and strong stallions are to be found among them, but unfortunately they are not used for breeding purposes but as saddle horses.

The *Java* horse is an insignificant, weak animal, suitable only for light draught. It is bred chiefly in the mountains; the best animals, however, are found in the rich grazing districts of the south coast.

The last breed of the Sunda archipelago which deserves mention is the *Preanger*, which owes its origin to the crosses of Persian, Arabian and east European stallions with Java mares. Later Australian, Ca

ndalwood, and Macassar blood was introduced for its improvement. on this mixture of various bloods a breed has been formed which is ally suitable for riding and for driving. Unfortunately it is bred only the island of Preanger, and thus it is mostly known to the white popula- only by name. Its exterior conformation is especially harmonious.

90 - **Holstein Milk Yield.** — MARSHALL, F. R. (Bureau of Animal Industry, U. S. Department of Agriculture) in *The Journal of Heredity*, Vol. V, No. 10, pp. 436-439. Washington, D. C., October 1914.

The study reported in this paper relates to inheritance, through pater- and maternal lines, of factors controlling the production of butter-fat. consists in the examination of records of cows as reported in the Blue book compiled annually from the Advanced Register for the Holstein breed. Here only selected material is dealt with, as only the good yields registered. These were all seven-day records made at various ages and ing the pounds of milk yielded, pounds of fat and per cent of fat.

In Vol. 10 of the above Register, there were found 1317 cases of cows ing official records and whose paternal grandams also had records. In addition, there were 678 cases in which a record-making individual had a maternal grandam with a record.

The difficulty of variation in age was overcome by arranging the paternal grandam" and "maternal grandam" cards in two parallel s. Having a much larger number in the paternal set it was possible to get therefrom, for each maternal card, one in which the age of the cow of the grandam corresponded very closely. This arrangement left 665 rds in each group.

The coefficient of correlation for each group in respect to total milk, al fat and per cent of fat, is shown in the accompanying table (1).

Taking the opposing pairs of cards in order to see in which there was greatest similarity between the records of grand-daughter and grandam e following results were obtained:

	Number of cases in which resemblance was closest	
	on maternal side	on paternal side
Pounds of milk	403	262
Pounds of butter-fat	407	258
Per cent. of butter-fat	345	320

1) DAVENPORT's statistical method is adopted.

M. represents the average of the readings.

Em, the probable mean error.

σ , the standard deviation.

$\frac{E}{\sigma}$, the relative probable error.

r or $\sqrt{r^2}$, the correlation coefficient.

Er, the relative probable error.

	M	Em	G	E G	r
Pounds of milk.					
<i>Through Sires.</i>					
Grand-daughters	370.6	+ 2.29	88.5	+ 1.67	- 0.03 + 0.1
Grandams	475.3	+ 2.56	98.7	+ 1.95	- 0.03 + 0.1
<i>Through Dams.</i>					
Grand-daughters	393.4	+ 2.53	99.5	+ 1.95	- 0.012 + 0.1
Grandams	437.4	+ 2.09	80.8	+ 1.54	—
Pounds of butter-fat.					
<i>Through Sires.</i>					
Grand-daughters	12.68	+ 0.089	3.41	+ 0.062	- 0.04 + 0.1
Grandams	16.93	+ 0.108	4.14	+ 0.076	—
<i>Through Dams.</i>					
Grand-daughters	14.00	+ 0.101	3.97	+ 0.07	- 0.06 + 0.1
Grandams	15.83	+ 0.087	3.31	+ 0.06	—
Percentage of butter-fat.					
<i>Through Sires.</i>					
Grand-daughters	3.47	+ 0.009	+ 0.432	+ 0.008	- 0.107 + 0.1
Grandams	3.57	+ 0.011	+ 0.448	+ 0.008	—
<i>Through Dams.</i>					
Grand-daughters	3.55	+ 0.011	+ 0.445	+ 0.008	- 0.213 + 0.1
Grandams	3.50	+ 0.013	+ 0.488	+ 0.009	—

In the two sets of cases already discussed there was a smaller number of paternal than of maternal grandams, due to the fact that cows have many more grand-daughters through their sons than through their daughters. This objection and the further objection as to environmental influence upon total production is removed in a further study relative entirely to per cent. of butter fat.

In the second part of the study of this case there were taken record cows having record grand-daughters through both sons and daughters. The number of grand-daughters is 340 through paternal descent and 126 through maternal descent from 126 common grandams. Each grand was represented by not less than one nor more than six grand-daughters either line. Here also the ages of granddaughters and grandams in line correspond closely with those in the other line. The means, standard of deviation and coefficients of correlation in this case of common grand were as follows:

	M % fat	E	G	E	
<i>Paternal Descent.</i>					
and-daughters	3.52	+ 0.02	0.442	+ 0.01	$\frac{1}{2} = 0.157$
and-sons	3.51	+ 0.02	0.406	+ 0.01	$E + 0.028$
<i>Maternal Descent.</i>					
and-daughters	3.60	+ 0.02	0.489	+ 0.01	$\frac{1}{2} = 0.155$
and-sons	3.51	+ 0.02	0.406	+ 0.01	$E + 0.028$

The difference between 0.155 and 0.157 does not indicate any difference between transmission of the character of percentage of butter-fat in milk of young males and females. The impression to the contrary held by some of the breeders is not borne out by this investigation.

1 - **Economical Cattle Feeding in the Corn Belt.** — CORRON, J. S. (Agriculturist, Bureau of Plant Industry) and WARD, W. F. (Senior Animal Husbandman in Beef Cattle Investigations, Bureau of Animal Industry) in *U. S. Department of Agriculture, Farmer's Bulletin*, No. 588, 19 pp. + 6 figs, Washington, 1914.

The cattle-feeding business in the corn belt of the United States has changed greatly during recent years. Formerly steers from 4 to 6 years were fed in large numbers upon commercial foods at yards near granaries or mills, or on large farms where only the roughage was grown and the cattle were kept on full feed for six months or longer. This method, however, became too expensive, so the cattle are now usually fed in small lots up to the age of 18 to 36 months, utilizing the products of the farms.

The cattle were either grown in the corn belt itself or came from the western ranges. The native cattle were usually grown on the rougher lands or on small farms where dual purpose cows were kept. They were usually sold to local feeders as yearlings or two-year-olds. Some feeders raising animals of extra good quality raised their own feeders. The rapid advance in the prices of land and farm products made it unprofitable to compete with the western ranges in the production of stocker and feeder cattle. Therefore the breeding herds were greatly reduced or were changed to dairy cows.

On the other hand, the spread of dry farming has resulted in the best lands of the open range being taken up for grain-growing purposes, and the excessive liquidation of cattle has resulted in a shortage of feeder cattle and raised their price, so that securing feeders is a serious problem which must be solved by many farmers raising their own cattle. On the high-priced lands capable of intensive cultivation it is questionable if this can be done economically, but there are numerous farms within this region where a considerable proportion of the land is too rough for economical tillage and on which, with prevailing prices, stock cattle can be raised advantageously.

Cost of producing cattle. — The cost of raising a calf six months weighing 450 pounds varies from \$17 to \$23 in the West and from \$28 in the East. In a ranch in Kansas, where land is worth \$50 an acre, the cows being valued \$70 each and assuming that 85 per cent of them produce a calf every year, the cost of a calf is \$22.93 and at the age of 2½ years a steer is worth \$55. This figure is about the maximum cost of such a steer in the West, and many of the western ranches raise similar steers for less money. It has been observed that the cost of the calf will be a little less if it is weaned and the milk sold, than if it is allowed to run with its mother.

While in 1899, 883 857 calves, having an average value of \$10 were slaughtered in the wholesale slaughtering houses, in 1909, 2 500 calves with an average value of \$10 were slaughtered, an increase of 28 per cent. in 10 years, whereas the corresponding increase in cattle for the same period was but 47 per cent. This growing demand for veal has raised its price, until a calf will sell from \$8 to \$12 when only 2 or 3 months old, so that it is usually more profitable to sell them to the butcher than to raise them.

In order to determine as accurately as possible the cost of feeding, cost-accounting records were kept for two years on 24 Iowa farms. During the year beginning with the autumn of 1909 the average profit on 961 calves fed in 22 bunches was \$2.05 per head in addition to the profits on the 1646 hogs following these steers, and which received extra grain besides. Market prices in the spring of 1910 were such that a profit of \$6.67 per hog was secured. The following year 1910-11 proved unsatisfactory, due to prices which caused a loss of 78 cents per head on 1138 cattle that were fed on pasture. The 1646 hogs following these steers returned an average profit of \$3.33.

The following table shows the proportionate cost of different items based on the cost-accounting records of the 24 Iowa farms.

Percentage of the various expenses incurred in cattle feeding.

Year	Purchase price	Feed	Interest at 6 per cent	Labour	Shipping and selling	Total
1909-10	55.8	36.9	1.3	1.6	4.4	100
1910-11	59.9	31.8	1.8	1.8	4.7	100

In this table no account is kept of interest, taxes, and depreciation charges on the feeding plant, as these and other incidental charges are about offset by the value of the manure.

According to experiments made at the Missouri Experiment Station it appears that a bushel of maize will produce 6.9 pounds of gain when cattle are fed on pasture in summer, as against 5.6 pounds in winter feed. Therefore in general summer feeding is considered more profitable.

other hand winter feeding allows of the better use of the by-products of the better distribution of labour.

Formerly 6 to 8 months were required for making prime beef. Now they are rarely kept on full feed for more than five months.

The construction of a silo (over ground, on a circular base) is not economical unless at least 100 tons of silage are consumed. Besides, in years cheap alfalfa or clover, when hay is worth less than \$8 per ton, it is doubtful if silage costing \$3 a ton will prove economical. However, when it is dearer silage will be profitable.

Considering the limited margin of profit on breeding beef it is prudent to combine it with hogs following the fattening cattle, for the former give a greater quantity of the by-products. The best type of hog to run with cattle is a shoat weighing about 100 pounds; heavy nearly finished hogs are not profitable behind steers and should be placed by themselves. It is usually best to allow one shoat per steer when shelled maize is fed and two when ear corn is used. When the maize is ground or soaked, silage is used, the number of hogs would be less. The aim should be to have enough hogs to clean up all the waste maize.

The daily gain of the hogs varies with the conditions of the feed yard, the quantity and form of the grain given. In general one may reckon on one-fourths of a pound of pork per third of a bushel of shelled maize fed to a steer. When ear maize is fed the gains will be greater and when silage, or maize and cob meal is fed, less.

The gain will be greater if the steers are fed some leguminous hay or some concentrate high in protein, such as oil cake.

Nearly all farmers give the hogs some extra maize, which is fed away from the steers.

The shrinkage in weight in shipping cattle from Iowa to Chicago or from points in Kansas to Kansas City would be from 3 1/2 to 5 per cent of their live-weight, with an average of 4 per cent.

1. - **Origin of Karakul Sheep** (1). — YOUNG, C. C., in *The Journal of Heredity*, Vol. V, No. 10, pp. 445-447. Washington, October 1914.

Some 26 years ago Dr. Sinitzin described the various breeds of sheep of Bokhara that produce valuable lamb skins. He distinguished; 1) the small Arabi, 2) the large Arabi, 3) the Duzbai, 4) the Shiraz, and 5) the Zigai breeds. He considers the small Arabi as the origin of all the fur-bearing sheep of Central Asia, including the Malitch of Crimea, the Tshushka of Sarabia and the Reshetilev and Sokoliev of Poltova province.

According to this theory the small Arabi is descended from the Mamai, the oldest breed of domesticated sheep. But as the Mamai is a fat-rumped sheep (*Ovis montanus*) while all the Karakul breeds are broad-tails (*Ovis montanus*), the author does not endorse Dr. Sinitzin's classification; his own experience has shown him that when a long-tail sheep is crossed with a fat-rumped the result is a broad-tail, and while the first cross looks more like a typical Russian fat-tail (Jirnochvostaja), the second and third crosses

(1) See also No. 929, B. Oct. 1914.

[Ed.]

cannot be classified otherwise than as broad-tails. He therefore concludes that the Karakul breeds resulted from crosses of long-tail sheep on fat-rumps.

In all the cases observed by the writer the black pigment in the wool of the mature sheep did not oxidize into gray as is the case with the Arabi also with the Duzbai, for which reason he concludes that the small Arabi was a hybrid and a not very well fixed one, and that some black long-tail sheep together with a fat-rump entered into the formation of the breed.

The presence of fat-rump blood is easily traceable in the Duzbai, which has the long drooping ears that characterize *Ovis montanus*, the Roman nose, large head, very thick feet, enormous weight and a tail with fat-cumulation; besides, the Duzbai lambs frequently come fawn, which is the natural colour of the fat-rump.

According to information collected by the writer at New Bokhara 60 years ago there were neither Arabi nor Duzbai sheep in Bokhara; the only fur-bearing breed which produced beautiful fur was the black long-tail Danadar. In the spring of this year 1914 the writer was able to see the only flock of gray Danadar sheep which still exists in the Khanate of Bokhara, at about 100 miles from Old Bokhara, the capital of the Khanate. The owner of the flock said that after the conquest of Bokhara by Russia in 1865 the demand for Danadar lambskins increased and the natives began to cross their black sheep with white fine-wool Afghans. This in time produced the gray Danadar breed, the lambs of which produce skins with small curls rather open and lustreless. This introduction of white blood combined with fat-rump blood in time changed the black Danadar into the small Arabi. The cross of the black Danadar on the fat-rumps produced the Duzbai. The gray Shiraz evolved from the gray Danadar with a fat-rump admixture. The Zigai is a typical Russian breed that never existed in Central Asia, and if there are any they must have been taken there by Russian Tartars who settled in Turkestan. Sinitzin's large Arabi is the same animal as the Duzbai.

There can be no doubt that the Tshushka and Sokoliev — both black-tails — are also descended from the black Danadars. The Luk-Na of Tibet and the black Gadik of Afghanistan, some few of which are found between Mazar-i-Sherif and Cabul, are closely related to the black Danadar.

The writer has started an experimental farm in Bessarabia for the breeding of Karakul sheep; hitherto he has succeeded in securing Karakul sheep from the districts of Karshi, Kerki, Gissar, Tjarjui, Burdali, Karakul. In Bokhara the Karakul breeds are hastening towards extinction owing to the killing of all the good lambs and to the continuous infusion of fine-wool Afghan blood.

1153 — **Pasture and Grain Crops for Hogs in the Pacific Northwest.** — HUNTER, L. (Agriculturist, Office of Farm Management) in *U. S. Department of Agriculture Farmer's Bulletin* No. 599, 27 pp. + 9 figs. Washington, July 6, 1914.

Hog pastures in the Pacific Northwest of the United States are generally managed in one of the three following ways: 1. — Continuous c

Fig. 2. — Alternate pasturing
on which hay is made.

With the first method all the hogs the pasture will support are turned out and left there during the entire season.

The second method consists in dividing the pasture into two or more of equal area, which are used alternately every week or ten days. In case of clover and alfalfa the growth is allowed to become 3 to 4 inches high before the hogs are turned in. When the pasture consists of kale, and vetch, the growth is permitted to reach a height of 8 or 10 inches before the hogs are turned in. A pasture thus subdivided is capable of carrying a much larger number of hogs per acre. Immediately the hogs are removed the pasture is clipped with a mower and sometimes gated. The third method consists in using clover and alfalfa for both pasture and ley at the same time. The number of hogs turned to graze is limited that the usual crops of hay are made. When the forage becomes large to furnish desirable feed a sufficient area near the watering place is clipped with a mower.

In a few days the clipped area produces a vigorous growth of new shoots which the hogs feed without disturbing the rest of the meadow. If necessary more of the meadow is clipped as required. Different portions of the meadow are used in this way from year to year.

Mature breeding stock that is not expected to make any gain in weight requires but little if any additional feed when on good pasture. But hogs which are to be marketed for pork must be fed some concentrated food.

If they are to be sold when 7 to 9 months old, in order to make them reach the weight demanded by the market (170 to 225 lb.) it is necessary to feed them all the grain they will consume. Hogs that are marketed when 10 to 12 months old get a much lighter feed of grain (from 1 to 3 per cent of live-weight of the hog) or none at all during the grazing season.

Sometimes, instead of feeding the grain, the hogs are turned into a standing field of wheat, barley, peas or corn and allowed to feed until the crop is consumed. If they are provided with water, shade and salt, they require very little other attention, which saving of labour is very desirable during the busiest season of the year. This method is especially useful on the poorer soils, where the cost of harvesting is relatively high in comparison to the value of the crop and where the addition of more organic matter is very beneficial. The straw, pea-vines or corn stalks are cut in the autumn by a sharp disk harrow and ploughed in.

Wheat is generally hogged off for four to six weeks from about the stiffening stage. A soft variety of wheat with a smooth club type of head is the best for this purpose. The writer mentions two cases in which hogs turned on wheat made an average gain in weight of 160 lb. and 212 lb. per acre, valued respectively \$14.40 and \$15.73 per acre, while the wheat alone yielded 15 and 19 $\frac{3}{4}$ bushels per acre, the latter giving a net value of only \$8.04 per acre.

Field peas are one of the most satisfactory crops to harvest with hogs, which utilize them with very little waste. They may be used from the time

TABLE I. — *Crops for Western Oregon and Western Washington.*

Crops	When planted	Approximate date when used	Number of hours an acre will pasture
<i>Pasture crops.</i>			
Clover	A previous year	April 1 to November 1	8 to 16
Alfalfa	do.	do.	8 to 16
Rape in rows	April 1, 15 and 30	June 1 to November 1	8 to 14
Rape and oats	April 25 to May 15	June 25 to November 1	6 to 15
Rape and clover	May 15 to June 1	July 1 to November 1	6 to 15
Rape	July (in corn at last cultivation)	October 1 to April 1	5 to 8
Vetch	do.	do.	5 to 8
Vetch and wheat, vetch and oats, or vetch alone	September (on spring stubble)	November 1 to April 1	5 to 8
Vetch and wheat or vetch and oats	Early spring or early fall	November 1 to July 1	5 to 14
English rye-grass	September 1 to October 15	February, March and April	6 to 12
Winter wheat	September.	March to July 1	8 to 16
Vetch			
<i>Grain crops.</i>			
Beardless barley	Early spring	July 1 to July 20	—
Winter wheat	September and October.	July 10 to August 10	—
Field peas	Early spring	July 25 to October 1	—
Maize	April 20 to May 10	September 15 to November 15	—
<i>Succulent winter feeds.</i>			
Kale	Sown in March or April; transplanted in June.	October 1 to April 1	—
Squash	May 25	November 1 to January 15	—
Artichoke	April 1 to May 15	November 1 to April 1	—
Artichoke	Early spring		—

Crops	When planted	Approximate date when used	Number of acres will pasture
<i>Pasture crops.</i>			
Winter wheat	Early in September	October 15 to November 15, March 15 to June 1.	5 to 8
Clover	April, previous year	April 10 to December 1	8 to 15
Alfalfa	A previous year	April 15 to November 15	8 to 15
Kale or rape	April and May.	June 15 to December 1	8 to 15
Rape and clover	May 1	July 10 to November 15	6 to 14
Winter wheat	Early in May	June 1 to November 15	6 to 15
Wheat in maize	July 15 to 20 (at last cultivation of corn)	September 15 to November 15	6 to 12
Stubble field		August 25 to April 1	—
<i>Grain crops.</i>			
Beardless barley	Early spring	July 5 to August 1	—
Winter wheat	September and October	July 20 to August 20	—
Field peas	Early spring	July 10 to November 1	—
Spring wheat	do.	August 1 to September 1	—
Maize	May 1 to 20	September 1 to November 15	—
Blue barley or common beardless barley	Early spring	From beginning of autumn rains to midwinter	—
<i>Winter feeds.</i>			
Alfalfa hay	A previous year	November 1 to April 15	—
Sugar beets, mangolds, carrots, rutabagas	April and May	do.	—
Artichokes	April	October 15 to May 1	—
Unthreshed or bundle wheat	Autumn or spring	Late autumn, do.	—
Field peas (unthreshed)	Early spring	do.	—
Unthreshed or bundle barley	Autumn or early spring	do.	—

TABLE III. — *Crops for the arid and semi-arid districts.*

Crops	When planted	Approximate date when used	Number of hogs an acre will pasture
<i>Pasture crops.</i>			
Winter wheat	October	April 1 to May 15	6 to 10
Beardless barley	February or March	May 1 to June 15	5 to 10
Spring wheat	March	May 1 to July 1	5 to 10
Winter wheat or beardless barley	May	June 15 to August 1-25	5 to 6
Field maize and Early Amber sorghum	April 10 to May 10	July until autumn frosts	4 to 7
Stubble field		August 25 to April 15	—
<i>Grain crops.</i>			
Beardless barley	Early spring	June 20 until autumn rains begin	—
Winter wheat	October	July 1 " "	—
Spring wheat	Early spring	July 15 " " "	—
Field peas	February and March	July 20 " " "	—
Blue barley or the common beardless barley	do.	October 15 to February 10	—
<i>Pasture crops.</i>			
Red clover	Previous year	March 25 to November 10	10 to 20
do. with wheat, oats or barley	Early spring	After grain is harvested to Nov. 10	10 to 20
Alfalfa	Previous year	April 1 to November 1	10 to 20
<i>Grain crops.</i>			
Beardless barley	Early spring, April	August 1 to November 15	—
Club wheat	September or October	August 5 to September 15	—
Field peas	Early spring, April	August 20 to November 15	—
Field wheat	do.	August 20 to October 1	—

TABLE IV. — *Crops for the irrigated valleys.*

Red clover	Previous year	March 25 to November 10	10 to 20
do. with wheat, oats or barley	Early spring	After grain is harvested to Nov. 10	10 to 20
Alfalfa	Previous year	April 1 to November 1	10 to 20
<i>Grain crops.</i>			
Beardless barley	Early spring, April	August 1 to November 15	—
Club wheat	September or October	August 5 to September 15	—
Field peas	Early spring, April	August 20 to November 15	—
Field wheat	do.	August 20 to October 1	—

last peas are nearly mature until about October or until the beginning of the autumn rains.

Carefully conducted tests at the Minnesota Experiment Station show that hogs waste no more corn in the field than when fed in lots, and that they gather it as clean as most men do in husking. Farm experience bears out this conclusion, especially if a movable fence is used and the hogs are not mixed into more corn than they can consume in 15 or 20 days.

For summer and early autumn hogging-off, common early-sown beard-barley is used. For late autumn and winter use the more productive hard varieties are preferred, after the autumn rains have softened the clods and kernels.

The tables (pp. 1642-1644) give some data on the pasture crops used in western Oregon and Western Washington.

H - Pig Feeding Experiments in Germany. — KLEIN, in *Milchwirtschaftlicher Zentralblatt*, Year 43, Part. 47, pp. 452-458. Hanover, September 1, 1914.

Experiments were made with the object of ascertaining whether fish meal freed from fat and dried yeast can take the place of skimmed milk in the fattening of pigs.

In an eight-weeks preliminary experiment, three young pigs were given only skimmed milk besides a basal ration of potato flakes and barley; the other young pigs divided into two equal groups were given the same ration as the preceding three, with the difference that a part of the milk was replaced in one lot by fish meal and in the other by yeast. One portion of skimmed milk was always replaced by $\frac{1}{2}$ lb. of fish meal + $\frac{1}{2}$ lb. of potato flakes, or by 1 lb. of yeast. The course of the experiment was normal. The increase of live-weight per day and per head was as follows:

	lbs.
Lot I	1.24
» II	1.10
» III	1.13

The lower result yielded by the group fattened with fish meal is due to the lower amount of protein in the ration.

In a following experiment lasting 12 weeks the same pigs (minus one, which was eliminated) were divided into three equal lots. The rations were the same as in the preparatory period, with the difference that lot II had the skimmed milk replaced by fish meal and that an extra quantity of fish meal + potato flakes was given to replace the skimmed milk. Further, the yeast was steeped in warm water. The animals fattened with skimmed milk showed in general the greatest appetite, those fed with yeast the least. With this exception the course of the experiment was normal. The following is the increase of live-weight per day and per head.

	lbs.
Lot I	1.44
» II	1.42
» III	1.39

The small difference in the three lots leads to the conclusion that fish meal and yeast produced almost, if not exactly, the same effect skim milk. Yeast and fish meal, but especially the former, gave a better result with the older pigs than with the younger ones. As regards fish meal, this is probably due to the fact that the older animals gain more in fat and are satisfied with less protein than the younger ones, which have to form flesh also.

From the economical point of view the principal experiment yielded the following results. If for the skim milk the values of 1.07 *d* or 1.60 *d* per gallon be assumed, and for the other feeds the prices actually paid the market (fish meal 10s 6*d*, yeast 11s 6*d*, potato flakes 8s, and barley 7s 6*d* per cwt.), the cost of 1 lb. of gain in live-weight will be as follows:

Cost of skim milk per gal.	Lot I <i>d</i>	Lot II <i>d</i>	Lot III <i>d</i>
1.07 <i>d</i>	3.53	3.69	3.69
1.60 <i>d</i>	3.85	3.69	3.60

In general these results are in favour of fattening with skim milk. If the skim milk be valued at the low price of 1.07 *d* per gal., the best results are obtained with fish meal and the most favourable ones with yeast. But if the greater dietetic value of skim milk be compared with this result, the conclusion may be drawn that skim milk valued at 1.60 *d* per gal. is at least as advantageous for young pigs as for the older ones. Whenever skim milk may be purchased at a price below 1.60 *d* per gal. its substitution by fish meal or yeast does not offer any advantage.

The carcass weight and the quality of the flesh were the same in all three lots.

1155 - Apiculture in Uganda. - Communicated by the Acting Director of Agriculture, Uganda.

In 1907, Sir H. Hesketh Bell, K. C. M. G., Governor of Uganda, being impressed by the value of the exports of beeswax from German East Africa decided to introduce the industry into the Uganda Protectorate.

In August 1908 two natives of Uganda were sent to German East Africa to study the methods of preparation of beeswax followed in that territory. These men spent two months in German territory. On their return to Uganda they were sent out to instruct the peasantry in the preparation of wax.

The introduction of the beeswax industry was taken up in every district of the Protectorate. The idea was to put up log hives and encourage wild bees to take up their quarters in them. Tens of thousands of the hives were put up all over the Protectorate. Pamphlets were published in several native languages, and beeswax instructors were appointed in all the districts. The following statement shows the exports of beeswax from the Protectorate for the last five years:

Year	Lbs.	Value
1909-10	4 943	£ 154
1910-11	3 950	£ 162
1911-12	3 539	£ 162
1912-13	2 352	£ 117
1913-14	882	£ 42

There are several reasons for this failure of the effort to introduce a new industry. The quantity of wax obtainable from a hive of wild bees in Uganda is very small, several hives have to be taken to produce a small cake of wax. Natives found the taking of the hives unpleasant and the preparation of wax laborious; and since, when the process was complete, they got a smaller return than from any other method of earning money, the extraction of beeswax never became a popular industry. In fact, nearly all the wax which was produced was prepared by the beeswax instructors who were paid by the Government to teach the peasants.

The following is a brief account of the methods employed: "Log hives were put up in the branches of trees and a few of these were tenanted by bees. When the hives were nearly full, the bees were smoked out and the wax was taken. The brood comb and a small amount of honey comb were left in the hive. The honey was then squeezed out of the comb, and the wax was boiled. The floating wax was drawn off and strained. The wax was subsequently broken up and clarified by melting and straining".

5. - **The Silk Weaving Industry of Amarapura, Burma.** — SHROFF, K. D., in *The Agricultural Journal of India*, Vol. IX, Part III, pp. 254-287 + 6 plates. Calcutta, July 1914.

Sericulture in Burma has been almost exclusively in the hands of a few races of people, the Yabeins, who numbered about 2 197 in Lower Burma in 1891.

It also exists to a small extent in Upper Burma and the Shan States. The rapid decline of the industry is shown by the decrease in the number of silkworm breeders from 3102 in 1891 to 211 in 1911.

This decline is attributed to the following causes:

- 1). The crude and careless system of rearing and inter-breeding and consequent degeneracy of the breed.
- 2). The ravages of diseases.
- 3). The imperfect knowledge of the reeling of the silk and the consequent production of coarse, uneven thread unsuitable for local consumption or export.
- 4). The abundance, the cheapness and the superiority of the imported raw silk.

Raw silk is imported from the Straits Settlements, Siam, Indo-China, China and Japan. The value of the silks imported decreased from 15 805 Rupees (£195 000) in 1868 to 14 18 306 Rupees in 1910, but since then it has increased to 31 44 189 Rupees (£ 209 000) in 1913.

The imports from China appear to be supplanting those from the Straits Settlements elsewhere.

These figures do not support the opinions that the weaving industry of Burma is in a decadent condition owing to the competition of fine machine-made products. In 1911 there were no less than 18 621 persons engaged in silk spinning and weaving.

The writer gives an account of the types of silk and handlooms used by the Burmese, and descriptions of their designs. A cooperative credit society has been established, and improved methods of manipulating silkworms and handlooms are being introduced.

1157 - *Recherches en Sericulture en Cambodie.* — DE PLACOURT, MARTIN (Chef Services Agricoles et Commerciaux du Cambodge), in *Gouvernement Général de l'Indochine, Bulletin économique de l'Indochine*, Year 17, No. 108, pp. 388-389. Hanoi, phong, May-June 1914.

Since April 1913, the Agricultural Service of Cambodia has undertaken the work of improvement by systematic selection of the pure native breeds of silkworms. It was therefore decided that the Service would not purchase any more foreign cocoons for the production of eggs, but produce them in its own farms. With this object in view the Silkworm Breeding Station at Petit-Takéo conducted the breeding work in three lines: 1) pedigree line breeding; 2) reproduction from eggs selected from the best cocoon of the pure lines; 3) the breeding of the best cocoons for industrial purposes.

The results obtained from one year's work give every confidence in the ultimate success of this method. Two local breeds (one a white with yellow cocoon known as Tân Châu, and the other a greenish yellow with golden yellow cocoon known as Tân-sé) were brought to a state of absolute purity and improved with respect to increase of specific gravity of the cocoons and increased fecundity of the females. Thus, whereas formerly required 1635 cocoons of Tân Châu or 1870 cocoons of Tân-sé to weigh one kilo (three days after the worms begin to spin), at the end of the breeding experiments in February and March 1914 it required only 1400 and 1355 cocoons respectively. During the same period the egg-laying capacity of the females was increased from 275-350 per day to 400-450 with a maximum of 500-550, that is to say, that, according to the methods of calculation, the weight of cocoons from the eggs of 100 females would weigh from 55-66 lb. to 75-105 lb. The average price of 100 batches of eggs decreased from about 15 3d to 6d and the demand for supplies from the natives increased enormously.

These experiments at Petit-Takéo lead to the belief that pébrine has a marked tendency to diminish and disappear in Cambodia, because the local conditions are undoubtedly unfavourable to the completion of the life cycle of the disease, owing to the rapid evolution of the silkworms, 10 days being sufficient for the complete development of the two local breeds. Very badly diseased eggs (showing 200 corpuscles of pébrine in the field of the microscope) have been bred and reared with healthy eggs of the same breed. Only the new generations showing the most disease were reserved. It was found that not only the number of corpuscles gradually diminished, but cocoons have been obtained from the diseased eggs almost

nal to those from the healthy control lots and after 6 successive generations only $1\frac{1}{2}$ per cent of the individuals were diseased, showing only 68 corpuscles in the field of the microscope.

FARM ENGINEERING.

38 - **Motor Tillage Machine with Oscillating Spades turning Sideways.** — *Kaiserliches Patentamt, Patentschrift No. 273 777. Berlin, May 7, 1914.*

Several digging machines with movable spades have been constructed. Some the spades are attached to revolving drums and are driven into the

Fig. 1.

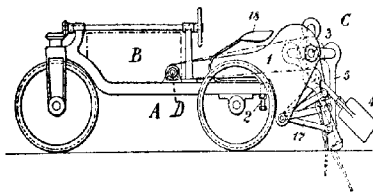


Fig. 2.

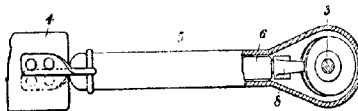


Fig. 3.

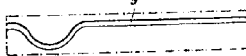
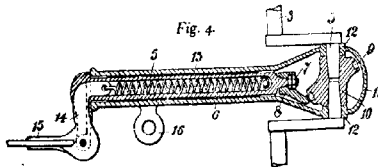


Fig. 4.



Motor Digger.

oil by the weight of the machine. In others they are independent of each other and move up and down by an eccentric. In both types the spades have also a lateral movement calculated to turn over the earth as it is loaded.

In this machine patented by H. Kleinert in Germany under No. 2737, the spades oscillate on a crank shaft and turn sideways to discharge or turn over the earth. Fig. 1 shows a side view of the machine and figs. 2, 3, and 4 some of its details. B is the motor, mounted on the truck frame, which propels the machine and drives the spading appliance C, which is born by two side plates (1), the front end of which is fixed to the frame in D by pivots; the other extremity can be raised or lowered by the screw (2).

The plates (1) carry the bearings of the crank shaft (3), each crank of which bears a spade holder (5). The cylindrical part of these holders contains the handle (6) of a spade (4), which is fastened to a knee piece working on a bolt situated on a lateral extension of the handle, the other end of the knee piece being attached to a spring (13) inside the handle (4). The upper end of this bears a head piece (8) carrying a roller that runs in a groove (9) in the head (10), which is fixed to the crank of the shaft (3) and which joins the two portions of the same crank (3). Each of these heads is enclosed in a case (11) fitted with two bearings (12). The case, which efficiently protects the mechanism against dust, earth, etc., is provided with means of lubricating the working parts to ensure smooth running.

On the outside of the holders an eye (16) is fixed for the reception of one end of the lever (17) (fig. 1), the other end working on a shaft, common to all the levers, fixed in the side plates.

When at work these spades are situated with their face to the direction in which the machine travels; as soon as they are raised they begin to turn sideways and thus discharge and turn the earth over. This turning motion is effected by the roller in the groove (9) of the head (10); the development of the groove is shown in fig. 3.

The spring (13) allows of stones and similar obstacles being encountered in the soil without causing injury to the machine.

1159 - **The Rapid Drying and Preservation of Wood by Nodon's Electrical Process.** DANTIN, CH., in *Le Génie Civil*, Vol. LXV, No. 5, pp. 98-101. Paris, May 30, 1906.

M. Albert Nodon, the electrician, has been studying since 1896 the subject of the rapid drying and preservation of wood, and has now perfected his system and rendered its application practical. He had discovered that the current of electricity sent through wood set up chemical, physical and aseptic actions which led to its preservation; the first of these consisted chiefly in a complete and rapid oxidation of the resinifiable substances contained in the sap. The physical action caused a molecular transformation in the cellulose and its numerous derivatives, modifying their mechanical and putrescible properties and rendering them resistant to destructive germs coming from without. Lastly, the aseptic action consists in the complete destruction of all the germs of corruption, such as ferments, bacteria, fungi, etc., contained in the wood. Besides the above effects it has been found that "nodonized" wood withstands the attacks of injurious insects such as termites, which no longer find in it their usual food.

One of the most important desiderata in the timber trade is the rapidity of seasoning timber, for any long stay in the timber-yard means an immobilization of considerable capital. Consequently the use of heated air

tilated esiccators is often resorted to, but such esiccation is mostly only superficial and on exposure to the air moisture is again absorbed. As the presence of sap hinders esiccation, steam at high temperatures and under pressure is often used to remove it, but this process is injurious to the resistance, tenacity and preservation of the wood and renders it inferior to dried wood. Besides, these processes of esiccation are expensive, as they are a costly plant, and much fuel and labour.

M. Nodon's process, or "nodonization", on the contrary, causes in a few hours the complete oxidation of the sap, which in air-drying requires

Fig. 1.

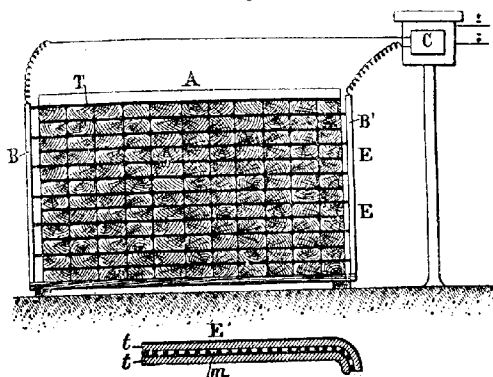


Fig. 2.

Fig. 1. — Section of a stack of railway sleepers under treatment.

Fig. 2. — Section of electrode mat.

B B'. Conductors to the mats.

C. Current distributor.

E. Electrode mats.

T. Sleepers.

m. Wire net.

n. Jute cloths.

for a long time; the substances other than cellulose, even in the innermost portions of the wood, are transformed into resins and completely deprived of their hygroscopicity; thus nodonized green wood loses its moisture rapidly on exposure to the air, while untreated wood dries only on the surface during the same time.

This process can also be applied to unbarked timber even 5 or 6 months after felling, as it still contains enough sap and moisture to conduct electricity.

The green timber to be treated, if in planks, railway sleepers, etc., is stacked to a height of three to five feet in layers separated from each other

by electrode mats in which the current passes (fig. 1). The mat (fig. 4) which can be rolled up for transport, consists of a pliable galvanised wire netting placed between two strong jute cloths. These mats are stretched between the tiers of timber and saturated with water to render them good conductors; the wire nets are connected with electric conductors the poles of the mats being alternated so that the current may pass through the thickness of each layer.

The conductivity of wood varies considerably with its kind, thickness, degree of moisture, etc. Its resistance varies from 6 to 20 Ohms per cubic meter (35 cub. ft.), but it remains fairly constant throughout the duration of the treatment. Continuous currents may be used, but alternating currents are preferred. Treatment in the forest where the timber is cut is very advantageous when the wood is in full sap and in summer. The trees are cut up by electric saws driven by a dynamo and a portable engine stored economically with the waste wood; after being nodonized, the timber is stacked in a place exposed to the wind where it dries completely in a few weeks.

The duration of the treatment varies between one and two full days according to the kind of wood and the use to which it is to be put. Wood treated too rapidly the wood is liable to split, though its keeping qualities are the same as if it had been treated slowly.

The total quantity of current that 1 cub. metre (35 cub. ft.) of wood must have for its complete treatment is 150 Ampère-hours. Wood in full sap does not require above 40 volts electro-motive power, while for unbarked wood that has been kept some time 80 to 100 are necessary.

Nodonized wood is freed from starch and contains resinified substance throughout its whole mass, and its cells present a characteristic regularity. These changes allow nodonized timber to be easily distinguished from that which has not been treated.

The cost of the plant consists in the source of the alternating current and in the electrode mats; the latter cost about 4d per square foot, as they last about a year. As 3 sq. feet are required for the daily treatment of 1 cub. foot of wood, the cost of the mats is about 0.03d per day per cubic foot.

The cost of nodonizing wood is about $\frac{3}{4}$ d per cubic foot, when the work is done in the forest, fuel, carriage and general expenses being cheaper than in factories, where the cost amounts to a trifle over 1d per cubic foot.

The process is useful wherever wood is used: in ship building, railway construction, carpentry, etc. The Municipality of Bordeaux has officially recognised that nodonized wood used for road paving lasts longer and wears better than untreated wood.

1160 - **A Latex Hydrometer.** — EATON, B. J., in *The Agricultural Bulletin of the Federated Malay States*, Vol. II, Nos. 9 and 12, pp. 224-226 and 314-322. Singapore, April and July 1914.

Messrs J. J. Griffin and Sons, scientific apparatus makers, Kenning Street, Kingsway, London, have constructed from detailed instructions

by the writer, a delicate glass hydrometer graduated at 84° F. An average pure latex containing about 30 per cent of rubber has a density about 0.98. A latex containing about 35 per cent of rubber is so viscous to render it impossible to test its density directly. It is therefore recommended in such cases to dilute with an equal volume of water. The rubber content will then be double that corresponding to the density of diluted latex.

Among the various services that this instrument can render is that of allowing the latex to be diluted with water to such an extent that its density will be constant. In this way very uniform results can be obtained in the preparation of smoked sheet. A satisfactory density figure at which to work is 0.9898, indicating a latex containing 15 per cent of rubber.

1. — **New Water-Raising Device.** — *Les Inventions Illustrées*, Year 17, No. 11, p. 3. Paris, April 30, 1914. — *Engineering*, Vol. XCVIII, No. 25232, p. 10. London, July 10, 1914.

Among the smaller machines exhibited at the Royal Agricultural Society's show held at Shrewsbury this year, a very interesting water-



Fig. 1

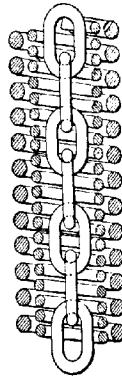


Fig. 2

New Water-raising Device.

raising device was exhibited. This appliance is virtually a chain pump, with the exception that the loop of an endless chain depending into the well. To keep the chain in place a deep rimmed pulley is slung in the lower loop of the chain. At the top end the chain is run over a pulley wheel worked by gear. This pulley is enclosed in a casing with a delivery pipe leading away from the lower portion. The chain consists of a link chain surrounded by a spiral, fig. 1, and for larger capacities by a multiple spiral, fig. 2. The lower part dipping into the well catches up the water while the spiral is retained by the curvature of the pulley, and retains the bulk of it till the upper part is reached, when the centrifugal force, while the spiral is

bent open at the top pulley, throws the water out into the casing, where it flows away. The capacity of this simple appliance is surprising, and it will handle water from considerable depths. The apparatus requires no permanent fixtures in the well at all, no buckets, guides, etc.

A double spiral 1.7 inches in diameter with a 5 HP motor is used to draw up from a depth of 196 feet 2090 gallons per hour.

At a depth of 33 feet a triple chain 2.48 in. in diameter can deliver 1000 gals. per hour with 2.4 HP. For wells in which the level of the water varies, the chain is made up in lengths which can be readily joined together by special hooks, so that about 2 feet of the chain should always dip into the water, with which immersion it has been found to give the best results.

On account of its simplicity this pump is not expensive; it is easily transported and to set up without skilled artisans.

1162 - Review of Patents.

Tillage Machines and Implements.

Austria	67 408. Device for regulating the depth of tillage machines with implements.
	67 402. Device for coupling agricultural machines to their tractors.
Canada	155 001. Motor plough.
	155 071. Gang plough.
	155 124, 155 488, 155 635. Cultivators.
	155 137. Clod-crusher.
	155 138. Traction belt for motors of the Caterpillar type.
	155 139. Traction machine.
	155 250. Plough with concavo-convex disk.
	155 357. Reversible plough.
	155 373. Weeding tool.
	155 393. Pulverizer for soil.
	155 412. Plough disk.
France	470 503. Device for increasing the stability of balance ploughs.
Germany	276 371. Ploughing machine with oscillating shares working back and forth.
	276 412. Tillage machine with rotating drum carrying spades.
	276 446. Stone collector with elevator screen and conveyor.
	276 447. Adjustable cleat for driving wheels of motor ploughs and the like.
	276 684. Cultivator share.
	276 828. Shaft with hoes for hoeing machine.
	277 065. Device for pulling and steering implements, especially for agricultural purposes.
	277 123. Device for lifting the chains of tillage implements attached to the tractor and drawn by levers.
	277 473. Plough with beam that can be raised or moved sideways.
	277 474. Tillage machine with oscillating spades driven by a crank.
	277 475. Device for lifting and lowering, by power, agricultural implements.
	277 610. Driving wheel for agricultural machines with moveable spokes fastened to the inside of the tyre.
Switzerland	66 441. Tillage machine.
	66 443. Spades with adjustable blades.
	66 863. Cultivator share.
	67 056. Plough share.

- ed Kingdom 10 969. Thinning machine, cultivators.
11 270. Digging machine.
12 780. Detachable point for protecting the points of the mould-board share and landside plate of a plough.
- ed States 1 106 603. Mechanically propelled plough.
1 106 722, 1 108 286, 1 108 319, 1 109 438, 1 109 661. Cultivators.
1 106 742. Caster wheel truck attachment for cultivators.
1 106 529. Motor plough.
1 106 389. Attachment for plough guards.
1 106 582. Plough beam.
1 107 173. Weeder for harrows.
1 108 600. Cultivator tooth.
1 108 261, 1 109 442, 1 109 813. Harrows.
1 108 787. Self-propelled ploughing machine.
1 109 076. Automatic guiding device for harrows.
1 109 095. Combined plough and cultivator.
1 109 535. Sulky plough.
1 109 063. Subsoiler.
1 108 909. Harrow tooth fastener.
1 109 084. Plough-lifting mechanism.
1 109 806. Gang plough.
1 109 756. Combined plough and fertilizer distributor.

Manure distributors, etc.

- ada 155 182. Manure loader.
155 300, 155 418. Manure spreaders.
- mark 19 063. Liquid manure distributor.
- many 277 030, 277 477. Manure distributors.
66 654. Manure distributors.
- itzerland 10 786. Apparatus for distributing insecticides, manures, etc., by means of an air blast.
- ed Kingdom 11 588. Manure distributor to be mounted on ploughs.
- ited States 1 108 263. Fertilizer distributor.
1 108 150. Manure spreader.
1 109 896. Straw spreading attachment for manure distributors.

Drills and Sowing machines.

- stria 67 401. Sowing machine.
- nada 155 059. Potato planter.
- many 276 303, 276 576. Potato planters with device for making holes.
276 866. Agitator wheel arrangement for drills.
277 066. Sowing machine in which the seed issues from holes in the side of the hopper.
277 201. Device for pressing and covering the seed, applied to drills.
277 029. Drill and dibble.
- itzerland 66 656. Apparatus mounted on wheels, for sowing in heaps, with knives to remove weeds and shares to open furrows.
- ited Kingdom 11 155. Potato planter.
12 844. Seed and like distributors.
- ited States 1 106 737. Combined disk harrow and seeder.
1 106 373. Corn planter.
1 109 835. Corn planter.

- United States 1 107 044. Cotton planter.
 1 108 130. Seed planter.
 1 108 435. Furrow opener for corn planters.
 1 108 878. Planter.
 1 109 711. Drilling attachment for disk harrows.
- Reapers, mowers and other harvesting machines.*
- Canada 154 990. Motor harvester.
 155 017. Hop-gathering machine.
 155 032, 155 618. Mowing machines.
 155 149. Carrier for harvesters.
 155 179. Grain shocking machine.
 155 405. Draft mechanism for harvesters.
 155 600. Stack hood.
- France 470 498. Improvements in horse rakes.
- Germany 277 124. Device for tilting and raising the cutter-bar in mowers.
 277 315. Cutter-bar for mowers.
 277 459. Scythe eye with adjustable excentric fastening.
- Switzerland 66 444. Mower with fore-carriage.
 66 445. One-horse side-delivery swathe rake.
 66 657. Device on mowers for cleaning the blades.
 66 864. Cutter-bar for mowers.
 66 865. Scythe.
 66 959. Apparatus for automatic loading of hay carts.
- United Kingdom 10 793. Grass box for mowing machines.
 11 508. Motor mower.
 11 582. Tedding attachment for mowers.
 12 397. Horse-rakes.
 12 586. Aprons for harvesting machines.
 12 766. Appliance for collecting and cocking hay.
 13 320. Harvesting machine.
- United States 1 107 083. Cotton harvester.
 1 106 652. Sheaf loader.
 1 108 536. Vertical mower.
 1 108 150. Mowing machine.
 1 109 525. Nozzle for cotton pickers.
 1 110 158. Cotton picker.
 1 109 711. Hay gathering and stacking machine.
 1 109 687. Harvester.
 1 109 897. Hay-rake.
 1 109 688. Corn harvester and husking machine.
 1 109 664. Hay pitcher.
- Machines for lifting root crops.*
- Austria 67 403. Device for holding beets in beet-topping machines.
- Canada 154 924. Potato digger.
- Denmark 19 249. Machine for loading beets.
- United States 1 106 668. Potato harvester.
 1 108 341. Combined beet puller and topper.
- Threshing and winnowing machines.*
- United Kingdom 12 828. Improvement in beater of threshing machines.
 13 082. Threshing machine.
- United States 1 109 428. Seed cleaner.

Other agricultural machines and implements.

- 67 302. Butter worker with intermediate gear.
- 67 530. Lid for milk pails.
- 67 531. Butter pressers.
- 154 881, 154 882. Baling machines.
- 154 928. Churn.
- 154 979. Sheaf loader.
- 154 998. Milk cooling and bottling apparatus.
- 155 009. Tool handle.
- 155 153. Milk separator.
- 155 156. Tractor.
- 155 157. Sprayer for plants.
- 155 233. Butter moulding apparatus.
- 155 267. Milk can.
- 155 323. Rossing machine.
- 155 449. Fibre breaking machine.
- 155 643. Traction belt.
- 155 652. Animal trap.
- 155 658. Peat working machine.
- 155 727. Machine for sharpening millstones.
- 155 759. Baling press.
- 155 797. Hay press.
- 155 835. Poultry feeder.
- 155 842. Incubator.
- 19 062. Device for milking machines.
- 19 064. Machine for singling beets.
- 19 229. Apparatus for freeing animals in stables.
- 19 234, 19 280. Automatic straw presses.
- 19 273. Apparatus for heating milk for a certain length of time.
- 470 945. Stand for drying hay.
- 276 305. Apparatus with agitator for extracting wax from empty honey-combs.
- 276 448. Central cone for milk separators, formed of several rings kept together by adhesives.
- 276 577. Potato peeling machine.
- 276 641. Drum for milk separator.
- 277 067. Adjustable nozzle.
- 277 096. Incubator with automatic heat regulator, cooler and ventilator.
- 277 225. Apparatus for rendering milk and other liquids homogeneous.
- 277 381. Apparatus for catching insects.
- 277 476. Machine for excavating ditches, canals, etc.
- 277 575. Fore-carriage for agricultural machines.
- 277 576. Milk skimming pan.
- 66 442. Appliance to keep agricultural machines mounted on wheels at the proper distance from the power machine.
- 66 446. Supports for strawberries.
- 66 447. Feeding trough.
- 66 448. Apparatus for untying cattle.
- 66 449. Cattle drinking trough closing automatically.
- 66 728. Curd-cutter.
- 66 961. Adjustable railing for feeding troughs in stables.

- United Kingdom 10 772. Machine for gauging and sorting corks.
 11 002. Milk cans.
 11 164. Propagation and seeding boxes.
 11 220. Hopper truck for spreading tea to be dried, fermented, et
 11 224. Appliance for gathering fruit.
 11 271. Traction engine.
 11 321. Shoots for conveying sacks.
 11 398. Luminous paint lamp-trap for insects.
 11 401. Horticultural frames.
 11 411, 11 518, 11 726. Cow-milkers.
 11 705. Machine for stemming tobacco leaves.
 11 931. Apparatus for hulling coffee, grinding maize, wheat, etc.
 11 977. Implement for tapping rubber trees.
 12 138. Apparatus for extracting oils by means of volatile solven
 12 141. Megasse furnaces.
 12 230. Baling press.
 12 414. Machine for cleaning and sorting potatoes.
 12 459. Machine for reducing oyster shells, spices, maize, etc.
 12 736. Animal traps.
 12 873. Combined incubating and rearing apparatus.
 12 984. Trap for flies.
 13 037. Separator for grain refuse.
 13 240. Sack holders.
 13 328. Churns.
 13 436. Rotary malting drum.
- United States. 1 107 001, 1 110 298. Tongue trucks.
 1 106 512. Hay carrier.
 1 106 405. Plant replanter.
 1 106 580. Hay press.
 1 108 203. Levelling device for traction engine.
 1 108 373. Ensilage machine.
 1 108 325. Stalk puller.
 1 108 163. Feeding device for feed cutters.
 1 108 599. Baled hay conveyor and elevator.
 1 109 456. Litter carrier.
 1 109 429. Farm tractor.
 1 109 294. Tractor wheel.
 1 108 882. Bug and worm collector.
 1 109 752. Wagon steering gear.
 1 109 789. Wagon loader.
 1 109 687. Seed germinator and plant forcer.

1163 - **Bold Concrete Dam.**— *Engineering Record*, Vol. 69, No. 25, p. 693. New York
 June 20, 1914.

In 1907 a dam was built, on a firm lava rock, across the Crow Creek in Idaho, U. S. A., for irrigation and domestic needs. It is 55 feet high and its plan is a curve of 72 feet radius, the convex side being turned into the stream. It is of unreinforced concrete and only 5 ft. 2 in. thick at the base and 3 ft. at the top. It has been found very satisfactory as it has held more than a foot of water flowing over it on several occasions.

Recently it has become desirable to increase the reservoir capacity, a State permit has been granted for the raising of the original structure to a height of 90 feet. The thickness at the bottom will be increased 3 ft. 2 in. and at the top to 3 ft. 2 in. The length of the crest will be 223 ft. At its central point it will be 1 foot lower than at the wing walls, towards which the crest slopes gently upwards so that the overflow tends to concentrate at the centre, but in flood seasons the entire length between the wing walls becomes a spillway.

When filled to the 90 ft. level, the reservoir will cover 66 acres to an average depth of about 36.4 feet, storing 2400 acre-feet.

RURAL ECONOMICS.

4. On the Selection of Crop Rotations. — MARENGHI, E., in *L'Italia Agricola*, Year 51, No. 10, pp. 436-438. Piacenza, October 1914.

1. In the application of economics to agriculture the various difficulties which interfere with the realisation of the maximum profit may be classed *objective* and *subjective*. The former are due to certain external conditions quite independent of the ability of the person directing the enterprise. Inevitable divergence entailed by many systems of cultivation from most suitable type, is often due to the very specialised character of the land itself.

The possibility of re-organising agricultural exploitation is therefore conditioned, at least partly, to the special conditions prevailing. Generally, rapid and radical changes are not possible, since they involve loss of capital invested in the soil. For example, although it would be comparatively easy to replace one herbaceous crop by another in a short time, it would be more difficult to extend the forage area and still more difficult to replace one kind of woody growth by another. Admitting that agricultural exploitation can be modified with relative rapidity, no state of equilibrium can be reached, owing to the inevitable dynamism of all the economic factors.

2. The *subjective* difficulties, on the other hand, are due principally to the incapacity of the farmer.

The systems of cultivation suffer always necessarily from the great difficulty of forecasting coming economic events, provisions never being determined by facts.

3. A system usually followed, and which enables serious errors to be avoided, consists in adopting from time to time only those methods which are found to prevail and which therefore are presumably sanctioned by experience.

4. The systems predominating in the different zones should be regarded as attempts of the cultivators to realise a maximum profit. Though it is not that this is never completely realised, the predominating or general

system in vogue should be regarded as the best organised and the most remunerative.

The data for the solution of this problem can be obtained from various sources, amongst others, the Land Register, which indicates the distribution of the various crops in the different districts. From an examination of the distribution of crops in the hills and plains of Perugia it has been possible to deduce a rotation which fairly illustrates the subject question.

5. It is presupposed that the different combinations of crops differ in one sense or another from that giving the maximum return; but this supposition corresponds only approximately to the facts. It often happens that all or almost all the combinations in question are affected by the same error, especially where too much importance is attached to establishing usage. Even in this case, however, much valuable information may be obtained by observation of facts.

6. Analogous results are more often obtained by the data furnished by statistical observations during a single year and grouped according to the ability of the various cultivators, which may be excellent, mediocre or bad.

The system of cultivation adopted by the most capable agriculturist and which consequently approaches the most remunerative, is a suitable model for the particular conditions of situation and time. But in this case also some reserve is desirable; for though in general the most progressive systems should be followed, it sometimes happens that excellent agriculturists make the same collective error of economic forecasting.

As an instance of this the writer mentions the vine-growing crisis in Apulia several years ago.

Similarly, statistical observation of crop systems has only a very approximate practical value, since it can only provide rather vague and schematic indications, though in any case more trustworthy than the data given by analytical book-keeping. The latter method is only suitable as a help — in the most favourable case — for the solution of small questions of detail and not for the tracing with any reliability of the fundamental basis of rotation systems, which must be selected in the various practical cases.

1165 — **Statistical Data on the Economy of the Farms Belonging to the Cooperative Book-keeping Association of Königsberg in Prussia.** (1) — *Österreichische Georgica*, Year 7, No 51, p. 437; No 53, pp. 453-454. Königsberg, June 25 and July 2, 1914.

During the year 1912-13 the average distribution of crops in the 14 farms belonging to the cooperative book-keeping association was as follows: 19.8 per cent of the cultivated area was under winter cereals, 18.8 under spring cereals, 3.6 under pulse, 6.5 hoed crops, 46.8 forage crops, 2.1 fallow and 2.4 per cent miscellaneous.

The capitals invested in the farms since the year 1904-05, the first

(1) See No 927, *B.* August 1913.

of the existence of the Association, have been, per acre of cultivated area, as follows :

Year	Number of farms	Buildings	Live stock	Dead stock
		£ s d	£ s d	£ s d
1904-05.	18	6 9 4	2 15 11 ¹ / ₂	0 17 5 ¹ / ₂
1905-06.	45	6 12 1 ¹ / ₂	2 17 11	0 17 10 ¹ / ₄
1906-07.	57	7 4 5	3 2 3 ¹ / ₂	0 18 3
1907-08.	70	7 4 5	3 3 1	0 18 3
1908-09.	74	7 8 4 ¹ / ₂	3 5 10 ¹ / ₄	0 18 7 ³ / ₄
1909-10.	89	7 10 4 ¹ / ₂	3 6 7 ³ / ₄	0 19 10
1910-11.	96	7 13 11 ¹ / ₄	3 5 5 ³ / ₄	1 0 7 ³ / ₄
1911-12.	118	7 15 6 ¹ / ₄	3 9 5 ¹ / ₄	1 1 9 ³ / ₄
1912-13.	145	7 1 3	3 17 9 ¹ / ₄	1 5 9 ¹ / ₂

The decrease in the value of buildings during the last year is due to the fact that the value of the owner's residence is deducted from the total value of the buildings. The sudden increase in the value of the live and dead stock in the last year is caused by having reckoned as cultivated area only the fields, meadows, and pastures, while in the preceding years a portion of the areas occupied by yards, roads, ditches, and other waste land was also included.

The figures for the individual farms vary according to the degree of intensity of the farming ; thus the capital in buildings ranges from about £4 to £12, that in live stock from £2 to £6, and that in machines and implements from £1 to £3.

If the figures for the individual farms be grouped according to the extent of the cultivated area, the following table is the result :

	Number of farms	Buildings	Live stock	Dead stock
		£ s d	£ s d	£ s d
I up to 617 acres	34	7 9 2	4 10 6	1 16 1
II from 620 to 1235 acres	58	7 2 5	4 2 1	1 5 0
III 1237 " 1852 "	31	6 17 3	3 3 6	0 17 6
IV above 1852 acres	20	6 18 1	3 2 8	0 17 6

The average stock of live stock increased from about 16.6 head of large cattle per 100 acres of cultivated area in the year 1904-05 to 20.2

	Number of farms	Net Returns of profits	£ s d per acre											
			From live stock	From sale of produce	Sundries Outlay	Purchase of live stock	Manures Fodder	Salaries and wages	Upkeep of build- ings and imple- ments	Sundries	Value of wheat used in pay- ments in kind			
1911 12	118	1 89	4 10 10	2 85	1 14 11	0 7 6	3 4 3	0 13 6	0 9 6	0 9 6	0 17 3	0 5 11	0 11 6	0 5 4
Average of period 1904- 05 1911-12	71	0 18 0	3 11 10	2 10	1 23	0 8 7	2 14 9	0 12 11	0 4 0	0 69	0 14 10	0 49	0 11 6	0 4 4
1912-13	145	0 15 8	3 18 2	2 11 2	0 19 10	0 7 2	3 5 1	0 12 4	0 7 6	0 9 11	0 19 10	0 57	0 9 11	0 5 2
Average of period 1904- 05 1912-13	70	3 16 2	3 12 7	2 21	1 11 0	0 8 7	2 15 11	0 12 8	0 4 0	0 7 2	0 15 6	0 49	0 11 6	0 4 4

in 1912-13, while the number of draught animals has remained fairly constant at an average of 4.2 head.

The year 1912-13 closed with considerably lower net profits than the preceding year 1911-12, and has thus lowered the average of the net profits, as may be seen from the table opposite, in which the net profits are given as average of all the farms, for the years 1912-13 and the periods 1904-05-1911-12 and 1904-05-1912-13 shown.

The value of these farms, calculated by capitalising the average net profits at the rate of 4 per cent, amounts to about £20 per acre, which is considerably below the prices paid now for farms; in other words, the net profits obtained represent a low interest on the capital invested. If the owner is to have adequate interest on his capital and to pay his private expenses, such as interest on debts, taxes, housekeeping, etc., out of the rents of his property, without loss, the average net returns should be, according to the writer, increased to at least £1 per acre.

Comparative Cost of Food for a Heifer, Stall-fed or at Grass, up to her First Calving. — ZWANOWETZ, EDUARD, in *Wiener Landwirtschaftliche Zeitung*, Year 64, No. 53, p. 656. Vienna, August 26, 1914.

The writer works out as follows the cost of food for a cow at two and a half years, according as she has been exclusively stall-fed or has been put to graze in summer. (She is supposed to have been calved on the 1st of September).

TABLE I. — *Cost of Food for Stall Feeding.*

1. Nov 1 to April 30, age ½ year		£	s	d
132 gallons whole milk, at 8 ¼d		4	10	0
220 lbs. crushed oats and oatmeal, at 6s 9d per cwt.		—	13	4
880 lbs. tender meadow hay, at £2 2s 6d per ton		—	16	8
880 lbs. mangolds, at 12s 9d per ton		—	5	0
		£	6	5 0
2. May 1 to Oct. 31, age 1 year				
814 lbs. oats, at 7s 8d per cwt.		2	15	6
1628 lbs. hay, at £2 2s 6d per ton		1	10	10
814 lbs. straw of spring grain, at 25s 6d per ton		—	9	3
300 lbs. green fodder, at 8s 6d per ton		—	12	6
		£	5	8 1
3. Nov. 1 to April 30, age 1 ½ year.				
95 lbs. rye bran, at 6s per cwt.		1	1	6
10 lbs. dry fodder, at £2 2s 6d per ton		—	3	0
10 lbs. straw of spring grain, at 25s 6d per ton		—	14	0
50 lbs. mangolds, at 12s 9d per ton		1	3	0
		£	4	1 6
Carried forward		£	15	14 7

	Brought forward . . .	£ 15 14
4. May 1 to Oct. 31, age 2 years.		
202 lbs. rye bran, at 6s per cwt.	—	10
16200 lbs. green fodder, at 8s 6d per ton.	3	1
405 lbs. straw of spring grain, at 25s 6d per ton	—	4
	£	3 16
5. Nov. 1 to April 30, age 2 ½ years		
405 lbs. rye bran, at 6s per cwt.	1	1
814 lbs. dry fodder, at £2 2s 6d per ton	—	15
1528 lbs. straw of spring grain, at 25s 6d per ton	—	18
6070 lbs. mangolds, at 12s 9d per ton	1	14
	£	4 10
Total cost of stall feeding	£24	1

TABLE II. — *Cost of Food at Grass.*

1. Nov. 1 to April 30, age ½ year.	£	8
As in Table I	6	5
2. May 1 to Oct. 31, age 1 year.		
Pasture, 184 days at 3d	2	6
3. Nov. 1 to April 30, age 1 ½ year		
As in Table I, but without bran	3	0
4. May 1 to Oct. 31, age 2 years		
Pasture, 184 days at 4d	3	1
5. Nov. 1 to April 30, age 2 ½ years.		
As in Table I, but without bran	3	8
Total cost at grass	£18	0 1

Thus the difference in favour of pasturing is £ 6 os. 5d.

1167 — **A Metayer's Family in Chianti (Tuscany).** — TASSINARI, G., in *Atti della Accademia Economico-Agraria dei Georgofili di Firenze*, Series 5, Vol. XI, pp. 283-310. Florence, October 1914.

In order to enable comparisons to be made with other monographs on this subject, the data in this monograph have been arranged according to the plan elaborated by LE PLAY. The metayer's family which is the subject of this study represents with fair approximation the average type of farmer in the Chianti district from the point of view of economic conditions and moral and intellectual characteristics.

The holding is on hilly land and it comprises about 17 acres of arable land, with vineyard and fruit trees containing about 3500 vines, 2070 fruit and other trees, and 87 acres of woodland and rather extensive pasture.

The area under herbaceous crops comprises about 7 to 10 acres of wheat (10 acres being the maximum), 2 ½ acres under forage and 4 ½ acres under the first crop after deep cultivation, which may include maize, beans, potatoes, tomatoes, etc; broad beans, chick peas and lentils are also grown.

ainfoin and a little lucerne are grown as forage crops, and barley, oats, vetches, beans, etc., are sometimes grown for the same purpose.

The manure used is chiefly dung, particularly from sheep; chemical manures are rarely employed.

The farm products (those from the woodland being excepted) and the profits on the live stock are shared equally with the landlord, who provides half the cost of the seeds required and pays the estate taxes. The taxes on live stock are shared by the tenant and landlord. The house, garden and fire-wood are regarded as free allowances to the tenant, and the landlord is charged with the cost of fungicides. The annual charges of the tenant amount to about 400 ft of trenches for vines, etc., and 10 head of poultry.

The family includes 6 persons: 4 men and 2 women. The live stock belonging to the farm includes: 2 oxen, 1 sow, 4 pigs, 37 sheep and 6 lambs, valued at £ 100; the dead stock leased includes forage, litter and manure valued at £ 43, implements valued at £ 12, wine vats and materials for other stores valued at £ 6: the total, including poultry, reaching about £ 145. The furniture, utensils, linen and clothing of the family are estimated at about £ 68.

The family balance sheet is summarised as follows:

	£	s	d
Farm products, farmer's half-share	78	7	8
Other profits allowed in the contract.	15	3	10
Total Receipts	93	11	6
Expenses for permanent and temporary work, seeds, imple- ments, machines, etc.	20	9	3
Net Profit	£ 73	2	3

The total family expenses consume £67 4s 2d per annum, leaving £13 8s 10d more or less, which goes to increase the credit of the metayer with the landlord.

This corresponds to a share of annual earning of £18 14s 11d per worker or £13 8s 10d per consumer of the family (1).

AGRICULTURAL INDUSTRIES.

- **The Origin, Quantity and Signification of Lactic Acid in certain Italian Wines.** — MENSIO, C., and CARINO CANINA, E., in *Le Stazioni Sperimentali Agrarie italiane*, Vol. XLVII, Part 6, pp. 385-409. Modena, 1914.

An attempt has been made to determine the quantity of lactic acid naturally formed in some of the finest Piedmont wines as compared with the quantity in common wines; what are the conditions under which such fermentation takes place; what are the micro-organisms producing it; what is its biological significance.

This year's expenses have been increased owing to the military service of one of the workers, so that £15 figures in the account as outside labour.

The main results of the investigations are as follows:

1). Lactic acid is a constituent of all wines and may be present to the extent of 4 to 5 gms. per litre.

2). The amount increases gradually as the wine ages and though advantageous at first it may become distinctly injurious. In the case of many wines, e. g. Barolo, Barbaresco, Gattinara, malo-lactic fermentation is essential for the development of their organoleptic qualities. It is also of great importance for ordinary wines, especially those with a low percentage of alcohol.

3). This fermentation is due chiefly to micro-organisms analogous in shape and behaviour to *Bacterium gracile* of MÜLLER-THURGAU, which splits malic acid into lactic and carbonic acids but has no action on tartaric acid.

4) Malo-lactic fermentation causes a considerable decrease in the acidity of the wine.

5). "Turned" wines (containing decomposition products of tartaric acid and extractives which give rise to a disagreeable flavour and loss of the wine) are fortunately rare in Piedmont.

6) In testing wine for its origin, whether genuine or artificial, the determination of the lactic acid should never be neglected.

From a practical point of view it is important to remember that wine after a certain age should be considered as the product of two fermentations: the first and most important being the alcoholic fermentation and the second the malo-lactic fermentation. Wine makers should watch their wines with a view to increasing, preventing or retarding the decomposition of the acids according as it is desirable. The acidity may be diminished by retarding the racking, maintaining the cellar at a suitable high temperature, and avoiding the use of sulphurous compounds. The decomposition of the acids may be retarded by using sulphurous acid when making the wine, maintaining the cellar at a low temperature, and by the prudent repetition of the sulphurous acid treatment.

1169 - **Spanish Wines.** — DE LA ROSA, G. FERNANDEZ, in *Boletín de Agricultura y economía*, Year VI, No. 67, pp. 622-626, Madrid, July 31, 1914.

According to the most recent statistics the area of vineyards in Spain is 3 396 460 acres, of which 1 891 160 are free from phylloxera, 1 047 400 have been reconstituted and 457 880 are infected and decadent, but still productive.

The methods of cultivation are, in many districts, antiquated and empirical. Propagation is by cuttings planted in holes and cultivation generally consists in ploughing, with hand-hoeing round each plant. Pruning is done annually and all the grapes are picked at once. In the best vine-growing districts, such as Jerez de la Frontera, Puerto de Santa María, Sanlúcar de Barrameda in the province of Cadiz, and several districts in the provinces of Malaga and Cordova, very different systems are practised. Before planting the vineyard the land is deeply trenched and then roughly hoed over several times to aerate the soil; pruning, removing the surplus shoots and gathering the grapes are done at several times.

The best Spanish wines are the "finos" and "olorosos" of Jerez, "manzanilla" of Sanlúcar, muscatel of Málaga, "Pedro Ximenez" of Jerez, "pajarete" of Bornos, "tintilla" of Rota, "Cariñena" of Huesca (white wines); the wines of Alicante, Valdepeñas, Mudela and Calatrava in the Mancha; those of "Priorato" in Catalonia; Penedès and Rioja (red and rose-coloured wines).

The average annual production of grapes is 2 905 537 tons, of which 74 tons are used for direct consumption, and 2 631 464 tons are used in wine-making, producing 3 883 000 gals. of must. The average price has been 6s 2d per cwt. of grapes and 7.89d per gallon of new wine. The average annual value of the wine products amounts to £14 454 138, not including £530 063 for lees and vinasse. It should be pointed out that the value would be considerably increased if it were based on the value of mature wine instead of on the must and on new wine only a few years old.

Notwithstanding serious difficulties, the cultivation of the vine and wine-making in Spain are always improving, chiefly through the influence of technical centres, among which should be mentioned the Oenological Institutes of Haro (Logroño), Villafranca del Penedès (Barcelona) and Reus (Tarragona).

- **The Wines of Istria.** — BUFALINI, D., in *Giornale Vinicolo Italiano*, Year 40, No. 37, pp. 865-867. Casale Monferrato, September 13, 1914.

Agricultural conditions in Istria are little known to the outside world. During the last 10 years very rapid progress in the wine industry has been made, and this still continues. Istria may be divided into the following wine-growing districts:

1. The Karst with the district of Castelnuovo.
2. The eastern coast with the districts of Albona and Volosca.
3. The southern coast with the districts of Pola, Dignano, Rovigno and Parenzo.
4. The northern and north-western coast with Tirano and Campo Tizzana.
5. The mountain region and high plateau of the interior with Pisino and Pinguente.
6. The islands of the Quarnero: Cherso, Lussin and Veglia.

In a good year the total yield of wine in Istria reaches 13 200 000 gals. of which nearly half is exported.

The local wines are as follows:

1. "Vino terrano" or "refoteo" from white lands, characterised by deep red colour and pronounced acidity.
2. White wine without special character, made from grapes which yield a considerable product: Isolana, Durania, Malvasia, Dinella, Terzana, Tebbiano, Drasanella.
3. "Vino rosato", rich in alcohol and with limited acidity, rose coloured with an agreeable flavour, obtained from grapes which always yield well: Rossara, Planiva, Negra tenera, Bontempa, Moretta, Pignone, Crenatizza.

4. White muscat made from the grapes of the same name, especially in the districts of Buie, Momiano, Verteneglio.

5. The rose muscat wines of Dignano.

6. Sweet and sparkling "Refoschi" wines.

The foreign varieties grown successfully on American stocks are: 1. miner, Pinot, Malvasia, Rhenish Riesling, Semillon, Burgundy (la bunched variety), Cabernet, Chasselas, Früher von der Lahn.

The control of phylloxera by replacing the vineyards with American stocks has enabled the introduction of foreign stocks which improve the local varieties. The production of large quantities of wine of uniform quality, which formerly presented such difficulties, is now an accomplished fact.

The provincial cellar of Parenzo produces about 110 000 gals., those of Brioni and Buie from 220 000 to 264 000 gals., the social cellars of Rovigo and Cittanova 11 000 gals. Vine-growing is the principal, though not the only, resource of the land in Istria.

1171 - The Influence of Nitrogen Compounds on the Vulcanization of Rubber

— *The India Rubber World*, Vol. 4, No. 6, pp. 650-651. New York, September 1, 1911.

In the rubber industry it has not been until recently that the importance of small quantities of nitrogen compounds found in most rubbers has been recognized.

WEBER considered the protein contents of latex as "impurities" which may be eliminated by good coagulation.

Dr. DAVID SPENCE (*Journal of the Society of Chemical Industry*, 1911, p. 1287) investigated the distribution of protein in rubber and found that in the insoluble part there was sometimes as much as 5.4 per cent nitrogen; this would mean about 33 per cent protein.

SCHIDROWITZ in 1911 noted that plantation rubber is usually deficient in nitrogen.

At the Eighth International Congress of Applied Chemistry held in New York in 1912, CLAYTON BEADLE and H. P. STEVENS described their investigation of *Hevea* latex. They found that the latices contained 1.31 to 1.56 per cent protein; that the percentage of protein of the solids varied from 5.1 to 5.5, and that about one half of this protein was retained in the washed and coagulated rubber in the form of dry matter. The same STEVENS in the *Colloid Zeitschrift* (Vol. XV, Nos. 1 and 2, pp. 36-49 and 86-96, Dresden and Leipzig, July, August, 1914), showed that the nitrogenous constituents had much influence, and the non-nitrogenous constituents little influence on vulcanization.

CLAYTON BEADLE and H. P. STEVENS separated the protein from rubber which contained the nitrogen, from smoked sheet. (1) Then they vulcanized the nitrogenous part and the nitrogen-free part and the non-nitrogenous part. It was found that the part of the rubber with high nitrogen contents vulcanized more rapidly and combined with more sulphur than

(1) See No. 131, B. Feb. 1913.

sheet and that the nitrogen-free part combined with the least. The strength and resiliency of the nitrogen-containing part was the greatest. The question then arises whether nitrogenous compounds may be added to rubber to act as hasteners of vulcanization or to give improved effects.

In the *Gummi Zeitung* (Year 28, No. 19, p. 731, Berlin, February 1914) it is shown that albumen added to rubber increases the speed of vulcanization.

In the French patent No. 466 243, scrap rubber is heated with caustic soda and a small quantity of an aromatic amino compound, which acts as a catalyst to unite the free and combined sulphur with the alkali. In German and English patent piperidine or its homologues are added to vulcanizing masses; in another patent piperidine or its homologues are used for producing hard rubber by adding 25 per cent sulphur.

In other patents the following substances are used: the derivatives of piperidine, aliphatic amines with open or closed chains, the addition product of carbon disulphide and dimethylamine, aniline, naphthylamine, a paste of albumen and lime.

Almost all the above-mentioned agents are organic nitrogen compounds, and this in the form of amines, and this authorizes the conclusion that this nitrogen has some catalytic influence in hastening the combination of rubber and sulphur, and in polymerizing the rubber itself.

With the use of large quantities of plantation rubbers which are known to be deficient in both proteins and other nitrogen compounds, and which are recognized as being much slower in vulcanization than Para, it would be desirable to determine on some substance, like the above, which acts as a hastener.

The Cause of Acidity in Fresh Milk of Cows and a Method for the Determination of Acidity. — VAN SLYKE, L. L., and BOSWORTH, A. W. (New York Agricultural Experiment Station) in *The Journal of Biological Chemistry*, Vol. XIX, No. 1, pp. 73-76. Baltimore, Md., September 1914.

The fact that milk is strongly alkaline to methyl orange would indicate that its acidity is due to the presence of acid phosphates of the type H_2PO_4 . Now when phosphates are titrated with alkali in the presence of calcium salts, some of the insoluble dicalcium phosphate (CaHPO_4) is dissolved during the titration hydrolyses, changing into calcium hydroxide and phosphoric acid, and then the calcium hydroxide unites with more calcium phosphate to form tricalcium phosphate, which appears as a precipitate. These conditions occur when the acidity of milk is determined

by usual methods with $\frac{N}{10}$ caustic soda, and the free phosphoric acid

increases the acidity as measured by titration.

Serum was separated from whole milk by filtration through a porous glass filter and the titration figure given by whole milk was about twice that obtained with the serum. This difference has been ordinarily interpreted as being due to the acidity of milk casein, but as the writers have evidence that casein is present in milk in the form of a neutral com-

pound and the other constituents removed by the filter are fat and calcium phosphate, both of which are neutral to phenolphthalein, it would appear that the cause of the discrepancy is the removal of the dicalcium phosphate which permits the formation of phosphoric acid.

The writers therefore suggest that in estimating the acidity of milk samples, the calcium should be previously removed by treatment with saturated solution of neutral potassium oxalate at the rate of 2 cc. p. 100 cc. of milk.

1173 - **Ability of Streptococci to Survive Pasteurization.** — AYERS, S. REZA (Bacteriologist) and JOHNSON, WILLIAM T., JR. (Scientific Assistant, Dairy Division, Bureau of Animal Industry) in *Journal of Agricultural Research*, Vol. II, No. pp. 321-330 + 3 diagr. Department of Agriculture, Washington, July 1914.

It is generally assumed that cocci do not form spores and the vegetative cells would not be expected to withstand Pasteurization. It has been shown, however, by the writer and others, that certain strains of lactic-acid bacteria, which would be classified among the streptococci, and perhaps some streptococci found in cream, are able to survive Pasteurization.

The writers have resumed the experimental study of the question and they summarize the results obtained as follows:

1. When the heating was performed in milk for 30 minutes under conditions similar to Pasteurization the thermal death-points of 139 cultures, streptococci isolated from cow feces, from the udder and the mouth of the cow, and from milk and cream, showed a wide variation. At 60°C. (140°F.) the lowest Pasteurizing temperature, 89 cultures, or 64.0 per cent, survived at 62.8°C. (145°F.), the usual temperature for Pasteurizing, 46, or 33.1 per cent, survived; and at 71.1°C. (160°F.) 2.6 per cent of the cultures survive all were destroyed at 73.9°C. (165°F.).

2. The streptococci from the udder were, on the whole, less resistant than those from milk and cream more resistant to heat than those from the mouth of the cow and from cow feces. When heated to 60°C. all of the 18 cultures from milk and cream survived; at 62.8°C. 17, or 94 per cent, survived at 68.3°C. (135°F.) 9 cultures, or 50 per cent, withstood the heating process. All the streptococci from milk and cream were destroyed by heating 73.9°C. for 30 minutes.

3. Among the 139 cultures of streptococci there were 22 that formed no chains and were considered (following the practice of some board of health laboratories) as typical streptococci. The others were considered atypical (The writers, however, do not believe the chain formation a proper basis of classification). Of the 22 typical streptococci, 12 survived heating for 30 minutes at 57.2°C. (135°F.), 9 at 60°C. and only 1 at 62.8°C. All of the typical streptococci were destroyed at 65.6°C. (150°F.).

The 117 atypical streptococci were more resistant; at 60°C. 68.4 per cent survived, at 62.8°C. 38.5 per cent survived, and at 71.1°C. 2.5 per cent survived; all were destroyed at 73.9°C.

4. Two classes of streptococci seem to survive Pasteurization:

a) Those which have a low majority thermal death point but among which a few cells are able to survive the Pasteurizing temperature. 11

ity of a few bacteria to withstand the Pasteurization temperatures may be due to certain resistant characteristics peculiar to a few cells, or may be due to some protective influence in the milk.

b) Streptococci which have a high majority thermal death point. When it is the case the bacteria survive because the majority thermal death point is above the temperature used in Pasteurization. This ability to withstand destruction by heating is a permanent characteristic of certain strains of streptococci.

5. The thermal death point determinations in this work were made in such a manner as to represent actual conditions of Pasteurization in the holder process; consequently the results show what may be expected in commercial Pasteurization, and it is evident that some streptococci survive the process. However, different results might have been obtained if a larger number of cultures had been studied and if other methods of media had been used for determining the thermal death points.

- **Action of Bacteria on the Ripening and Flavour of Cheese of the Cheddar Type.** — I. — EVANS, ALICE C. (Bacteriologist, Dairy Division, Bureau of Animal Industry), HASTINGS, E. G. (Bacteriologist, Wisconsin Agricultural Experiment Station) and HART, E. B. (Chemist, Wisconsin Agricultural Experiment Station). *Bacteria Concerned in the Production of the Characteristic Flavour in Cheese of the Cheddar Type.* — *Journal of Agricultural Research*, Vol. II, No. 3, pp. 167-192. Washington, June 15, 1914. — II. — HART, E. B., HASTINGS, E. G., FLINT, E. M. (Chemist, Dairy Division, Bureau of Animal Industry) and EVANS, ALICE C. *Relation of the Action of Certain Bacteria to the Ripening of Cheese of the Cheddar Type.* — *Ibid.*, pp. 193-216.

I. — This is a continuation of previous investigations (1) consisting in many bacteriological analyses of cheeses in order to determine fully the distribution of the groups of bacteria in ripening cheese; in a detailed study of the pure cultures obtained, with the view of relating the presence of certain types with desirable or undesirable in our production.

In the previous work the pure cultures were obtained by isolation from case-agar plate cultures and from dilution cultures in sterile milk. In the present study the dilution cultures were made in milk to which was added 1 gram of peptone, 1 gram of dextrose and 200 cc. of water per litre. It was found to be more favourable for the development of some of the cheese organisms. An effort was made to obtain two pure cultures from a series of dilution cultures: viz. the predominating organism of the *Lactobacillus lactis acidii* and coccus groups, and the predominating organism of the *B. casei* group. The former was obtained by plating — in casein — to which 1 per cent. of dextrose was added — the culture from the first dilution of the cheese which shows a growth after two days incubation; the latter was obtained after three weeks' incubation. On every plate a portion containing 10 colonies was circumscribed, and the inclosed colonies were fished off into litmus milk.

(1) See No. 868, B. July 1913.

Those cultures from a single plate which caused the same changes in litmus milk and were of the same morphology, were considered of the same variety. Representatives of every variety were studied in detail. This method, which allows the examination of a large number of cheeses and gives a rough picture of their flora, was considered the best adapted to increase present knowledge on the subject.

The cultural characteristics, morphology, and the few biochemical reactions which are ordinarily considered in classification of bacteria, were found to be inadequate for distinguishing one variety of cheese organism from another of the same group. Therefore the system of classification based upon the fermentation of various test substances, used by Gordon and others, was adopted.

The results obtained by the writers are summarized as follows: The organisms constantly found in Cheddar cheese in such numbers as to indicate that they must function in the ripening process are included in four groups: *Bacterium lactis acidii*, *B. casei*, *Streptococcus* and *Micrococcus*. On the basis of the fermentation powers, each of the four groups may be divided into a number of varieties, the distribution of which in Cheddar cheese, prepared from both raw and pasteurized milk, has been studied. The flora of raw-milk cheese includes all the varieties into which the groups were divided. The flora of pasteurized milk cheese, with the exception of the *Bacterium casei* group, is dependent upon the flora of the starter. It seems that the pungent taste that develops late in the ripening period of both raw milk and pasteurized milk cheeses is due to the *Bacterium casei* group. It is probable that growth of this group continues during the major part of the ripening period. The action of two or more organisms growing together is not the sum of their individual actions when growing alone. When growing together they may attack substances that neither can attack alone or they may produce a larger quantity of acid than the sum of the quantities that either can produce alone. When added to pasteurized milk, the organisms of the *Bacterium casei* group produce a sour taste in the cheese during the early part of the ripening period. No Cheddar flavour is obtained in pasteurized-milk cheese when the organisms of the *Bacterium lactis acidii* group alone are used as starters. The varieties that are able to ferment the more complex substance are likely to produce a bitter taste.

Starters composed of both *Bacterium lactis acidii*, *b*, and *Streptococcus*, when added to pasteurized milk, improve the quality of the cheese. It does not seem unreasonable to hope that starters may be obtained that will give the characteristic Cheddar flavour to the cheese prepared from pasteurized milk.

II. — In a preliminary investigation of the non-nitrogenous constituents of Cheddar cheese, the very pronounced differences that were expected in the quantity and variety of volatile acids, esters and alcohols in good and poor types of cheese were not found. But since there were certain differences which could be only of biological origin, it was believed essential that the substances formed by the specific groups of organisms normally present in cheese should be more carefully studied. It was thus hoped to find

groups of organisms to which the production of definite non-nitrogenous compounds that could be correlated with flavour production might be attributed. The compounds particularly sought were the alcohols, esters, and caproic and butyric acids. Formic, acetic, propionic, lactic and succinic acids were also included in the list of substances to be isolated. To some extent the sources of these bodies were also studied.

The writers summarize as follows the results of their very numerous and varied experiments:

1. Representatives of the coccus groups of organisms isolated fromeddar cheese, when grown in milk, produced large quantities of the fatty acids, particularly acetic acid. These acids were produced from lactose or lactose or protein, as the medium was practically free from fat. The coccus organisms did not produce formic acid. As they are present at times in very large numbers in cheese, they no doubt produce much of the volatile fatty acids which arise during the ripening process.
2. One of the strains of *Streptococcus b* was found to produce comparatively large quantities of alcohols and esters — bodies which contribute in a high degree to the flavour of cheese.
3. A dilute solution of acetic acid and alcohol formed esters by mere contact, without bacterial action.
- In cheese, however, the dilution is probably too great for this manner of ester formation.
4. Lactic acid was generally not formed by the coccus groups.
5. The representatives of the *Bacterium casei* group examined, gave results differing from those obtained from the coccus forms. They produced no formic acid, but did form some propionic and much acetic acid.
6. These organisms produced a large quantity of lactic acid, both active and racemic, and decomposed the citric acid of the media.
7. Cheese made from chloroformed fresh milk did not yield any volatile fatty acids, showing that inherent milk enzymes are not capable of producing these bodies in any appreciable quantity.
8. Representatives of both the coccus and *Bacterium casei* groups were found to produce ammonia from milk.
9. Whey and fresh curds contained active lactic acid. Cheese one day old contained a mixture of active and racemic lactic acids.
10. The cause of the disappearance of active lactic acid and the appearance of racemic acid may be due to enzymic action, combined with the action of those bacteria which can produce both kinds of acid.
11. Some representatives of the *Bacterium casei* group produced levulic acid and others dextro-lactic acid from milk. A mixture of these two species produced racemic lactic acid. A mixture of *B. lactis acidi* and a non-producing member of the *B. casei* group gave racemic and active lactic acid. The active acid was probably the result of the longer continued activity of *B. casei*.
12. Racemic lactic acid found in curing cheese may therefore be produced in a small degree by enzyme action, but more probably by

the combined action of *Bacterium lactis acidi* and the organisms of the *B. casei* group.

1175 - The Part Played by Micro-organisms in the Ripening and in the Production of the Pungent Flavour of Brindza, the Ewes' Milk Cheese made in Hungary. GRATZ, O., and VAS, K. (Experimental Dairy at Magyaróvár). — I. The part played by micro-organisms in the ripening and in the production of the pungent flavour of Brindza. — *Kísérleti Közlönyek*, Vol. XVII, Part 3, pp. 347-394. Budapest, May-June, 1914. — II. On some new species of micro-organisms found in Brindza. — *Ibid.* Vol. XVII, Part 4, pp. 635-644. Budapest, July-August 1914.

I. — The making of Brindza cheese differs essentially from that of other cheeses in that it is formed by kneading together several balls of curd prepared in different ways in different localities and under different conditions (1). The kneading, which is chiefly carried out in factories, undoubtedly causes a transformation of the bacterial flora and of the conditions of the enzymes in the paste of the balls. The objects of the present study are: 1) to determine the bacterial flora of Brindza and its qualitative and quantitative changes during the ripening of the stored cheese; 2) to identify the organisms which produce the pungent flavour in Brindza and to explain its presence; 3) to draw useful conclusions from the results obtained so as to improve the methods of making this cheese.

The experiments were made with five samples of fresh Brindza (some weeks old), which were subjected to control lasting six months. The bacteriological analyses were made at intervals of from 4 to 6 weeks.

The writers drew from their research the following conclusions:

1. The bacterial flora of Brindza is very varied. It includes *Micrococcus*, *Sarcina*, *Streptococcus*, *Bacterium*, *Bacillus*, *Actinomyces*, *Torula*, *Oidium*. Among the species isolated, there are several which have not hitherto been described in the literature on the subject. This great variety of microflora is to be attributed not only to the want of cleanness of the ewe's milk and to the bad rennet (made with water and easily liable to putrefaction), but also to contamination, during the making, due to the contact of the balls, the salt, the machines and implements.

2. Brindza is very rich in micro-organisms. There is no cheese with so high a germ content as Brindza, notwithstanding the fact that after it is made and during storage the multiplication of micro-organisms ceases. Most of these are lactic bacteria, especially *Bacterium casei*, *Streptococcus lactis*, *Micrococcus*; nevertheless, though very numerous (61 per cent), they do not attain the proportion that they reach in other cheeses (79 to 95 per cent). The cause of this is in the difference of manipulation, as compared with other cheeses, which introduces a large number of accidental germs and thus reduces the number of lactic bacteria.

3. The accidental micro-organisms, the presence of which is very instable, disappear soonest. Quantitative analyses have shown that during storage the content of germs in Brindza diminishes. At first the decrease is very marked, while later it slackens. Streptococci and cocci die most

(1) See No. 1669, B. Dec. 1912.

power than lactic bacilli, which are found together with their spores even in very strong Brindza.

4. Research has shown that the accidental micro-organisms do not take part in the ripening of the cheese, because its conditions do not favour either their development or the activity of their enzymes. The agents which cause ripening are therefore the lactic bacteria; nevertheless the enzymes of the rind of the curd balls also play an important part in the ripening of Brindza.

5. Results have demonstrated that the origin of the piquant flavour of some ewes' milk cheeses is due only in exceptional cases to butyric fermentation, and generally to a great decomposition of the fatty matter. This decomposition is not caused by the bacteria having the power of attacking fatty matter; this is proved by the fact that they have often been found in greater numbers in sweet Brindza than in strong pungent Brindza.

6. The agents of the great decomposition of fatty matter are enzymes and in the first place the lipase of *Oidium lactis*. The result is that if the outside of the curd balls (rich in butyric ferments and on which *Oidium lactis* is always present) and the fat layer under this outside (in which the enzymes are found) are not carefully removed when the cheese is worked up again, as is often the case, the above parts come into contact with the whole of the kneaded paste and communicate a pungent flavour to the cheese.

7. Observations made during the process of ripening have shown that strongly flavoured Brindza has a pale orange colour; it is dry, subject to crumbling, strongly smelling and never turns mouldy. On the other hand sweet Brindza has generally a normal consistence, but it becomes sticky and mouldy if it is not kept hermetically closed.

As for the practice of the manufacture of Brindza, the results of observations may be summarized as follows. It is not essentially necessary that Brindza should have a pungent flavour, because the origin of this flavour is not due to the action of micro-organisms the presence of which could not be avoided by the cheese-maker, but to the manipulation allowing the lipase enzymes existing on the rind of the balls to exert their influence, which has not hitherto been recognized. Knowing the factors which give Brindza this special taste, the cheese-makers will be able to modify it by adopting a suitable process of manufacture (careful removal of the rind of the balls).

The paper contains bibliographical notes, as well as diagrams and tables giving numerical results of the analyses made.

II. — Description of some new species of micro-organisms found during the research on the flora of Brindza and the part they play in the ripening and production of the special flavour of this cheese. Considering the various properties of these bacteria observed during their culture, and their biochemical action, they do not resemble any of the micro-organisms known so far to the literature of bacteriology. These new species are: *Bacterium saponificans*, *Bact. adipis*, *Bact. rufum*, *Bacillus gravidus*, *Bac. mergens*, *Bac. exilis*, *Bac. cerasinus*, *Bac. parabutyricus*, *Bac. indolicus*.

- 1176 - **The Phosphorus Content of Casein.** -- BOSWORTH, A. W., and VAN SLYKE, L. (New York Agricultural Experiment Station) in *The Journal of Biological Chemistry* Vol. XIX, No. 1, pp. 67-71. Baltimore, Md., September 1914.

The amount of phosphorus in casein has been commonly given about 0.85 per cent. By treating a solution of casein in excess of dilute ammonia with ammonium oxalate and letting it stand twelve hours, the phosphorus content is reduced to 0.71 per cent. This lower percentage cannot be explained as being due to hydrolysis of casein and splitting phosphorus, for though some of the casein is hydrolysed, the hydrolysed portion does not enter into the final preparation or affect its composition. The higher figure ordinarily given is due to the presence of inorganic phosphorus (dicalcium phosphate) carried from the milk into the precipitated casein and not entirely removed under the usual conditions of preparation. The lower figure corresponds very closely to two atoms of phosphorus in the casein molecule. Analyses of various preparations of casein containing varying amounts of ash show a general correspondence between the ash and phosphorus content.

- 1177 - **A Comparison between the Fat Stock and the Carcasses Exhibited at Smithfield Show, 1913.** -- LONG, JAMES, in *The Journal of the Board of Agriculture* Vol. XXI, No. 1, pp. 1-12. London, April 1914.

The Smithfield Club holds each December a show of pure and crossbred fat cattle, sheep and pigs. In 1896 a new section was added to the Smithfield show, for the best carcasses of beef and mutton, and the competition has continued ever since. In 1903 classes for pigs were added to the carcass section.

In the last competition the judges showed a decided preference not only for lean meat but also for small meat, and this applies to the carcasses of cattle and sheep as well as to pigs.

From the difference between the live-weight and the carcass-weight it appears that the younger the animal matures and can be finished at slaughter, the smaller will be the cost of producing a pound of meat, the better its quality and the smaller the waste.

In the 1896 carcass competition the two-year-old steers averaged 1323 lb. live-weight and 864 lb. in the carcass, or 65 per cent.

The average live-weight of steers under two years old is 1363 lb. On the Highland cattle, the average weight in the class from 2 to 3 years is 1772 lb., which exceeds the former by 409 lb., or an estimated difference in the carcass-weight of 266 lb. This shows that it cannot pay the feed to keep a steer for the additional year, since the actual weight of beef produced barely exceeds 5 lb. a week. The estimated carcass-weight of the steers under two years old is 886 lb., or 80 lb. more than that of the prize steers in the carcass class, while for steers between two and three years old, this estimated average is 1136 lb., or 282 lb. more than the actual average carcass-weight of the whole class. This difference represents much additional fat, that is, a factor which depreciates the unit weight of the meat.

In the classes for heifers similar results are obtained. The average live-weight of the older animals is only 1576 lb., against an average of 1322 lb. of the younger ones, showing an increase for one year of only 254 lb., which reduced to 165 lb. of carcass. It is evident that this cannot pay. The accompanying tables show the weights observed:

TABLE I. — *Average live-weights of pigs exhibited in 1913.*

Breed	Under 9 months		9 to 12 months	
	Live-weight	Estimated weight of carcass	Live-weight	Estimated weight of carcass
	lb.	lb.	lb.	lb.
Salines	335	268	400	320
Norths	314	250	476	380
Colins	402	321	469	376
gr Whites	383	306	490	392
Alle Whites	302	241	400	320
gr Blacks	396	316	508	406

TABLE II. — *Average live and carcass weights of sheep exhibited in 1913.*

Breed	Open classes	
	Live-weight	Estimated carcass-weight
	lb.	lb.
Wool lambs	172	94
Wethers	248	142
Wool lambs	177	99
Wethers	244	146
Crosses, lambs	187	108
Wethers	172	99
Wool and Mountain	299	180
Wool crosses lambs	164	90
Wethers	239	136
Wool lambs	152	83
Wethers	237	136
Wool lambs	200	112
Wethers	239	143
Wool lambs	137	78
Wethers	191	108

Prize lots	Carcass Classes	
	Live-weight	Actual carcass weight
	lb.	lb.
Long-wool lambs, all Cheviots	115	63
" wethers, all Cheviots	138	79
Short-wool lambs, Southdowns	95	54
" " Suffolks	134	75
" wethers, Southdowns	122	69
Other short-wools, wethers	160	98
Cross-bred lambs	120	58
" " wethers	164	98

TABLE III. — *Average live and carcass weights of steers and heifers, exhibited in 1913.*

Breed	Open classes			
	Under two years		From two to three years old	
	Average live-weight	Estimated carcass-weight	Average live-weight	Estimated carcass-weight
	lb.	lb.	lb.	lb.
<i>Steers.</i>				
Devons	1 290	839	1 803	1 172
Herefords	1 419	922	1 978	1 286
Shorthorns	1 483	964	1 873	1 217
Sussex	1 356	881	1 826	1 187
Red Polled	1 320	858	1 492	970
Aberdeens	1 352	879	1 760	1 144
Galloways	1 231	800	1 672	1 087
Welsh	1 391	904	1 722	1 119
Crossbred (1st cross)	1 421	924	1 925	1 251
" (2nd and 3rd cross)	1 368	889	1 667	1 084
<i>Heifers.</i>				
Devons	1 351	878	1 598	1 039
Herefords	1 298	844	1 556	1 011
Shorthorns	1 336	868	1 606	1 044
Sussex	1 372	892	—	—
Aberdeens	1 249	812	1 627	1 058
Crossbred (1st cross)	1 269	825	1 709	1 111
" (2nd and 3rd cross)	1 383	899	1 642	1 067

Carcass class	Average	Actual
	live-weight	carcass-weight
	lb.	lb.
steers under two years	1 226	806
" from two to three years old (the whole class)	1 330	854
heifers under two years (eight animals including the winners)	1 146	747
heifers from two to three years (Shorthorn-Aberdeen)	1 382	924

3. "Quality" in Wool. — BAILEY, P. L., and ENGLENDOW, F. L., in *The Journal of Agricultural Science*, Vol. VI, Part 3 pp. 349-370. Cambridge, September 29, 1914.

NATHUSIUS, BOHM, KONIGSBOM, BOWMAN, Mc MUTRIE and others have shown that "quality" in wool depends upon several factors, including

- 1) Fineness of fibre as measured by the average diameter.
- 2) Number of crimps or waves per unit length of the fibre.
- 3) Length.
- 4) Lustre.

The writers of this paper determined to repeat the work of the above writers and to subject the results to a statistical analysis. They studied fleeces of crosses of Shropshire ewes with Australian Merino rams. They examined over 700 microscopic slides and made about 30 000 measurements. The present paper deals in particular with the relation between "fineness of fibre" and the commercial grading of the wool.

At shearing, samples were taken from both of the shoulders, the neck, britch and the belly. A skilled Bradford sorter divided this wool into 16 classes indicated by numbers 64's to 40's, which are based on the spinning capacity of a given weight of wool.

For the microscopic investigation, four sub-samples, A, B, C, D, were taken from each sample; from each sub-sample three portions were cut off, one at the tip end (T_1), another from the middle (T_2) and a third from the base (T_3). Each portion was placed on a glass slide and fixed with gum. The measurements were made with a micrometer eye-piece, the division of the scale representing $\frac{1}{8000}$ of an inch. The figures in this paper are, unless otherwise stated, based upon a unit of measurement equal to one eye-piece-scale division.

The results and conclusions may be summarized as follows:

1. The method of taking four sub-samples and making in all 160 measurements of them gives a satisfactory value for the average diameter of the sample. The amplitude of the variation of the probable errors is only the range 0.064—0.154 or, as percentages of the averages concerned, 1 to 1.6 per cent. Thus, if the largest magnitude of the probable error be taken, the odds are 20 to 1 that the average of 160 measurements will be correct to within 5 per cent.

2. The average of the samples from each shoulder gives a good indication of the shoulder for each sheep. From a study of four cases showing exceptional fluctuation in the averages of the sub-samples it appeared that the probable error was 0.263 units, or a little over 3 per cent of the average. Consequently, even in cases of the greatest variability, one can rely upon the average obtained from the sub-samples representing the whole shoulder average to within 10 per cent. In the great majority of cases, it will be correct to within 5 per cent.

3. In comparing two sheep, A and B, we may take as almost certain significant a difference between their two average shoulder diameters such that the ratio

$$\frac{M_A - M_B}{s_{AB}} > 3,$$

that is a difference of some 8 per cent of the average shoulder diameter of either of them for measurements taken as here indicated. In other words, if the averages of the shoulder samples of two sheep differ by more than three times the standard error (1) of their difference, one may be satisfied that this difference is real and not due to any small variations in the position of the individual sheep from which the shoulder sample was taken.

4. A relationship exists between the fineness of the wool (as measured by the average diameter) and the commercial quality into which the wool is graded. But this relationship is not absolute. Thus, sheep that had suffered from a *Strongylus* attack, produced finer wool during the illness, so that the fibre presented a line of weakness with decrease of diameter. In such cases the average diameter is smaller and yet the commercial quality inferior.

There is a correlation between the fineness of wool and the number of crimps per inch, but this appears to cease after the number has reached about 23 per inch.

5. The average diameter at the tip is the best guide from a genetic point of view as to the fineness of the wool concerned, owing to the marked pathological influences which may affect the base average.

6. The distribution of the fibres of different sizes has a modifying effect upon the commercial quality which would be assigned from a consideration of the average size only. It is suggested that the standard deviation of the distribution of the fibres should be used as a measure of the modifying effect.

In the accompanying table are given the "qualities", the average diameter sizes (M) of the fibres in those qualities and the standard deviation (σ) of the distributions. An examination of the figures there given shows that in the case of T_1 there is a distinct parallelism between the quality assigned by the sorter to the sample and the standard deviation of the

(1) See C. B. DAVENPORT: *Statistical Methods*, 1904; also R. LOCK: *Recent Progress in the Study of Variation, Heredity, and Evolution*, London, 1911 (chapter on Biometry), pp. 30-1. (Ed.)

ample, a fall in "quality" being accompanied not only by a rise in the average diameter size, but also by a rise in the standard deviation. This latter rise cannot be explained as being wholly due to the rise in the average diameter, as is shown by the fact that there is also a rise in the efficient of variation $\frac{\sigma}{M}$.

In order to study more closely the question of influence of variability sample on the commercial quality, the percentage occurrence of diameters every size was calculated for all the qualities. From the Table of the numerical results the qualities are seen to group themselves into four classes:

Class I: the 60's and 58's. The fibre distributions for these two qualities are much alike and show a comparatively small dispersion.

Class II: the 56's. The distribution for this class is of the same general nature as that of the preceding class, but shows a distinctly greater dispersion.

Class III: the 54's and 50's. The distribution appears to be bimodal, and the range of variability is much increased.

Class IV: the 44's. Fibres distributed in two or three modes and tending to coarseness.

The writers make some reserves on the generalization of their results, owing to the hybrid nature of the sheep from which the samples came.

Quality	T_1 Average Diam.		T_2 Average Diam.		T_3 Average Diam.		$T_1 + T_2 + T_3$ 3	$T_1 + T_2$ 2
	M	σ	M	σ	M	σ	M	M
.....	8.11	1.47	8.11	1.52	5.41	1.25	7.21	6.76
.....	7.68	1.88	8.03	3.79	6.18	1.59	7.30	6.93
.....	8.28	1.92	8.28	1.84	7.16	1.70	7.91	7.72
.....	9.44	2.35	9.03	2.26	6.81	1.86	8.43	8.13
.....	8.93	2.19	8.83	2.21	6.92	2.45	8.23	7.93
.....	9.61	3.51	8.77	2.71	6.94	2.37	8.21	8.28
.....	8.36	2.11	8.18	2.37	6.18	1.92	7.57	7.52

- **Libyan Hides and Skins.** — Industrial Experiments on Sudanese and Libyan Hides and Skins (From a Report of the Director of the Royal Experiment Station of the Leather Industry at Naples) in *Ministero delle Colonie, Ufficio economico, Bollettino di Informazioni*, Year II, No. 7-8, pp. 531-535. Rome, July-August 1914.

The production of cattle in Tripoli¹ amounts annually to about 30 head. The animals are somewhat small, and weigh, on an average, 15 lbs. The salted and dry hides of adult animals received from Tripoli at the Royal Leather Experiment Station at Naples, weigh on an average 11 lbs.; the calf skins weigh 6 lbs., while those from Cyrenaica weigh respectively 15½ lbs. and 6½ lbs.

The hides from Cyrenaica were better than those from Tripolitania and more carefully sorted. In general, the products of both places were fairly good, being soft and of equal body and substance. They, however, had some easily eliminated defects (imperfect flaying and preservative brand marks, etc.) and some were perforated by warbles.

Goat breeding is extensively practised in Tripolitania. The goats are of medium size, with black or reddish hair; their tails are small and little covered with hair. The height of the withers is from 2 ft. to 2 ft. 2 in. Beneath the hair is a wool which the natives weave into materials for use. A goat weighs about 66-88 lbs. and the kids, which are sold when young, weigh from 11 lbs. to 15 ½ lbs. During the four months July-October 1913, 63 417 lbs. of untanned goatskins were exported from Tripoli and neighbourhood. The goatskins received from Cyrenaica and Tripolitania by the Royal Experiment Station at Naples are suited to working *à chevreaux*, according to the English system of *chromo* (tanning with gambier and a basic solution of chromium), for preparation of a special leather "Dongola" (tanned with alum and gambier), and for cheap Morocco (tanned with sumach, gambier and quebracho and dyed with anilin colours). The goatskins of Tripolitania and Cyrenaica have proved to be of good quality and sufficient substance, without much waste.

About 100 000 sheep are exported from Tripolitania. These animals belong to three species. The Orfella thin-tailed breed, the fat-tailed G. sheep with short legs, and the large Sudan animal which is without horns. In Tripoli medium-sized fat-tailed sheep are very plentiful. Their fleeces would be thick and uniform if they were well kept; but frequent diseases cause a partial loss of wool. The average weight of the Tripoli sheep is about 84 lbs., that of the rams is 88 lbs., while lambs 4-6 months old weigh 40 lbs., and those over a year old attain a weight of from 60 to 66 lbs. During the four months July-October 1913 about 117 115 lbs. of lamb and sheep skins were exported from Tripoli. The sheepskins received by the Royal Experiment Station at Naples were tanned as follows: 1) with the wool, for carpet leather; 2) for glove skins, from which excellent goods were obtained.

Libyan camel skins are not very important articles, as they are sold when the animals are killed because they are past work, or when they die a natural death. From July-October 1913 about 11 365 lbs. of camel skins were exported from Tripoli. They are very irregular in shape and very defective. When tanned, they fetch barely £1 8s 3d per cwt. inferior skins can be used for second quality sole-leather; those tanned with chromium serve for making lacings and straps.

1180 - Experiments on Storing Swedes during the Winter, in Denmark
58. Meddelelse fra Statens Forsøgsvirksomhed i Plantecultur. Ved. Statens Planteculturforsøgshave i Copenhagen, October 2, 1914 (Communicated by the Danish Correspondent to the International Institute of Agriculture).

The experiments were carried out during the four winters from 1910 to 1913 in the farms belonging to the Experiment Stations of Studsgaard, Varde and Holstebro.

Similar experiments made in 1906 showed that when mangolds were kept in large broad pits covered with seaweed and in field clamps, the loss in dry matter during the winter was not so great as when they were kept in cellars. The experiments which have now terminated show that the same holds true for swedes.

With a crop of swedes containing $59 \frac{3}{4}$ cwt. of dry matter per acre, the losses were 7 cwt. of dry matter when they were kept in large pits till the middle of March, 8 cwt. in field clamps, and upwards of $13 \frac{1}{2}$ cwt. when they were kept in cellars.

The loss with swedes is somewhat greater than with mangolds, and this is especially noticeable after the month of January. The cause of this lies in the fact that towards spring the loss caused by rot in the swede pits is much greater than in the mangold pits, and besides this, the direct loss of dry matter due to the vegetative activity of the roots seems to be greater in swedes than in mangolds.

In the choice between pits and clamps it must be borne in mind that the pits, besides causing a somewhat smaller loss during the winter, have also the advantage of being cheaper to cover and uncover than the clamps. On the other hand frost gets into pits more easily than into clamps; when no heather, seaweed or other suitable material is easily available, then clamps are to be preferred to pits. The experiments have shown that the winter losses in clamps are smaller when the ends are covered at once and the top only in December, unless continued frost should render this necessary sooner. The sides of the clamps were covered with earth and the top with heather.

The higher the temperature in the pit, the greater was the loss during the winter; the importance of attending to ventilation at once in the autumn in order to keep the temperature as low as possible in the pit, was proved. By a suitable arrangement of air passages in the bottom of the pit, the temperature was lowered during the first months by 1 to 2°C. (1.8 to 3.6° F.). The lower temperature diminishes the vegetative activity of the roots; consequently the loss of dry matter between autumn and the middle of March was $1 \frac{1}{2}$ cwt. per acre less in ventilated than in unventilated pits and 1 cwt. per acre less in ventilated clamps than in unventilated ones. As the value of the dry matter can be estimated at 5 s per cwt., the cost of ventilation is negligible in comparison to the loss that would be caused by neglecting to ventilate the pits. From New Year's day onwards the air passages in the pits were closed, as they had been previously during periods of frost.

When the clamps are made in the second half of October, the temperature in them is higher than when they are made at the beginning of November. The experiments have shown a loss of 16 cwt. of dry matter per acre when the clamps are made in October and not ventilated, as against 8 cwt. per acre when they are made in November. It is therefore advisable to make the clamps as late as possible, and if special weather conditions require the work to be done in October, ventilation becomes a necessity.

The loss of dry matter increases progressively from autumn to the middle of March; if the clamps remain untouched for another month, namely up to the middle of April, the loss during this month is equal to the total loss up to the middle of March. This is due to the fact that during the latter period a high percentage of the swedes rot in the clamps. On uncovering it in the middle of March, the loss during the succeeding month was one-third of what it is when the heap was uncovered in the middle of April. In districts in which mangolds are not grown and swedes must be available after the middle of April, it is useful to uncover the clamps in the middle of March. By measuring the temperature of the clamps, one can have an idea of the amount of the loss being caused. For this object special thermometers are made, by means of which the temperature is taken once every three days during the first month and once a week afterwards. If, in some points, an increase of temperature is noticed it can be lowered by uncovering that part of the heap.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

56. — Further Notes on a Disease of Red Clover in Tuscany (1). — I. BACCARINI, PASQUALE, and BARGAGLI-PETRUCCI, GENO. — II. DEL GUERCO, GIACOMO. — *Atti della Reale Accademia economica-agraria dei Georgofili di Firenze*, Series 5, Vol. XI, Part 2, pp. 23-96, figs. 1-12, 1 plate; pp. 133-183, figs. 1-39. Florence, 1914.

I. — The researches of Profs. Baccarini and Bargagli-Petrucci on the disease of *Trifolium pratense* known as "incappucciamento", which first appeared in several parts of Tuscany in 1908, have brought to light several factors concerned in the damage, but without definitely deciding which is to be considered as the true cause of the destructive disease in question.

The theory of degeneration of the seed sown in laying down the crop cannot be accepted in this particular case.

The following fungi have been isolated on several occasions from the diseased clover: *Sclerotinia Trifolium*, *S. sclerotiorum*, sterile mycelia of *Nyctophya* and *Helotium*, *Phoma* sp., *Botrytis cinerea*, *B. vulgaris*, *Torula* sp., *Fusarium melachroum*. Infection experiments have given results which, though not being definite, lead to the conclusion that the fungi, especially *Sclerotinia Trifoliorum*, *Botrytis cinerea* and *Fusarium melachroum*, cannot be considered as the ultimate causes of the disease.

Four types of bacteria have also been isolated, one of which (type *a*) more constant and abundant than the others; it is capable of liquefying agar and gelatine and evidently belongs to the genus *Micrococcus*. Inoculations of red clover with this organism have resulted in the production of the chief symptoms of "incappucciamento" in both field and pot cultures. Therefore appears that the ultimate cause of the disease is bacterial infection, probably with the organism of type *a*. Inoculation experiments with this organism tend to show that some lesion, natural or artificial, is necessary for the organism to gain entry. Such lesion may be caused accidentally

(1) See No. 181, B., Feb. 1914.

by mowing, or by the action of certain insects or other animals boring in stems and roots. Certain eelworms (*Heterodera*) have in fact been recorded on the diseased plants, and also insects belonging to *Apion*, *Hylastes*, *Anthrenus* (?), *Cecidomyia*, *Pteromalus*, etc. Of these, the species of *Cecidomyia* was found to be superficially infected by bacteria, among which type A was most abundant. The insects cannot be regarded as the primary cause of the disease, but rather as concomitant pathogenic causes (this may also be said of the fungi) and also disseminating agents of the bacteria, which they carry from plant to plant and inoculate direct into the tissues.

It is not very probable that a deficiency of lime in the soil can have given rise to the disease, nor can it be attributed to soil "sickness".

It is quite probable that the extensive floods of the Elsa in 1907 established soil conditions favourable to an intense development and a rapid spread of pathogenic organisms previously localised or sporadic. Another hypothesis may also correspond to the facts; it is well known that the metabolism of micro-organisms is liable to variations and extraordinary adaptations, and that slight changes in the conditions of the medium are sufficient to control the elaboration or suppression of definite substances (toxins or hormones). It is therefore by no means impossible that variations in the medium may exercise an influence on certain soil organisms so as to render them capable of a pathogenic action once they have gained entry into the tissues of the plant. From this hypothesis it would appear that the intensity of the bacterial action would gradually diminish as the soil recovered its normal condition, until it finally disappeared. The progress of this recovery would be facilitated by omitting clover from the rotation and substituting some other forage crop.

II. — Prof. DEL GUERCIO observes that clover attacked by a disease known as "stremenzimento" or "incappucciamento" in the provinces of Florence, Siena, Pisa and Arezzo, showed symptoms which were evidently not due to insect or other animal pests and other symptoms of a different nature caused by worms, molluscs and various arthropods (Crustacea, Arachnids, Myriapods and Insects).

The following insects are described in detail from the systematic and biological point of view, as pests of clover: *Rhizoberlesia trifolii* gen. et sp. nov., *Aphis scabiae* sp. nov., *Pemphigus trifolii* sp. nov., *Anthrotrips* sp. nov., *Cecidomyids*, *Apion* (especially *A. virens*), *Hylastinus* or *Hylastes trifolii*.

The writer considers that this disease of clover is similar to that of the dwarfing of other plants and draws the attention of agriculturists to the necessity of good manuring and rotation.

Though there is no doubt as to the damage caused by *Hylastes* and *Apion*, which is more than that due to *Cecidomyids* and *Tylenchus vastator*, no precise relation between these pests and micro-organisms can be determined in the present state of the researches. At present it can only be said that they are connected with damage to clover. It will be necessary to observe which action begins first and which is more effective in its results. The writer inclines to the opinion that insects and nematodes initiate the trouble and that subsequent developments of the disease are due to bacteria.

Future investigations should concern the relation between the microbes of the clover and of the soil, nematodes, insects and agricultural operations and the disease of clover, with a view to finding the best means of obtaining normal growth of this crop.

1182 - **Blossom-End Rot of Tomatoes.** - BROOKS, CHARLES, in *Phytopathology*, Vol. IV, No. 3, pp. 345-373, plates XXIV-XXVI, figs. 1-5. Baltimore, Md., October 1914.

Blossom-end rot or point-rot of tomatoes, first reported by Galloway in 1888, is of general occurrence in the United States and has been reported from Canada, Cuba, Australia, New Zealand and various parts of Europe.

The first symptom of the disease is a water-soaked appearance on the blossom portion of the fruit, followed by a spot at the base of the style or half a centimeter or more away from it, or, as is more commonly the case, the whole blossom surface of the fruit may be affected. In this stage the disease very much resembles a bruise. In a few days this dark green water-soaked area becomes black, later involving the whole blossom half of the fruit. The affected tissue collapses and becomes firm and leathery. This collapsing of the diseased tissue, together with the continued development of other parts of the fruit, may produce a definite depression on the blossom half of the fruit, but more often it results in only a flattening of the tomato.

The first effects of the disease are not always superficial. Fruit that appears entirely normal from an external view has often the tissue of several or sometimes all of its placentae collapsed and blackened in the parts nearest the blossom. In some cases this internal condition is accompanied by a very inconspicuous depression of the surface tissue above it or by a small water-soaked area on the surface.

The cause of the disease has been attributed to various organisms, viz. *Phylobacter lycopersicum*, *Macrosporium tomato*, *M. Solani*, *Fusarium crubescens*, etc., and many have regarded it as contagious. Recent results seem to show that it is not contagious and that its origin will be found along cultural and physiological lines.

Spraying experiments have generally given negative results, and the majority of authorities attach little importance to this means of control.

Culture experiments have led to the conclusion that neither bacteria, nor fungi, nor enzymes are the cause of this disease. Plants growing under the most favourable conditions are more liable to attack. Continued excessive watering, as well as a drought, may give rise to the disease. Manuring with potash salts in solution increases the disease in proportion to the amount of potash applied, whilst nitrate of soda causes a decrease in the intensity of the disease. These results were not confirmed in the field experiments. Nitrate of soda showed slightly less tendency to increase the disease than sulphate of ammonia or organic fertilisers having an equivalent amount of nitriser. Heavy applications of horse manure have increased the disease in all proportion to the increase in vigour of the plants. Plants well supplied with water on a sandy loam have developed less disease than those on clay loam. Raising the soil temperature of greenhouse plants has increased the disease. The writer is of opinion that the increase in the disease on heavy watering is due to the development of harmful humic and

ammonium compounds and an accompanying decrease in nitrate. Susceptible tissue contains more starch and more oil than normal tissue and its cell-sap has a higher osmotic value. The protoplasm of the cells from the fruit of the heavily-watered plants is more granular and contains more oil than that of the lightly-watered ones.

BACTERIAL AND FUNGOID DISEASES.

- 1183 - Contributions to the Cryptogamic Flora of Thuringia. — JAAP, OTTO, in *Annales Mycologici*, Vol. XII, No. 4, pp. 423-437. Berlin, 1914.

A systematic list of 300 species of Myxomycetes, Schizomycetes and Eumycetes, collected during the month of July in the years 1906 to 1911, various parts of Thuringia. Some of them are new to Central Germany and also to Thuringia. One of two species of fungi new to Science is *Emmophthora Jaapiana* Bubák, found on the hemipterous pest *Eucanthus tetraruptus* L. (fam. Jassidae). The list includes numerous fungi living on the resin of spruce, which are very abundant and well developed, especially in the woods near Oberhof.

- 1184 - Contribution to the Mycological Flora of Serbia. — RANOJEVIC, N., in *Annales Mycologici*, Vol. XII, No. 4, pp. 393-421, figs. 1-5. Berlin, 1914.

This third contribution contains 271 species of fungi collected chiefly during 1910 and 1911 and partly during 1913, in various parts of Serbia and on a large number of plants, many of which are cultivated otherwise of economic value.

Of these, two genera and 19 species are new to Science; large numbers are new to the district and occur on host plants of economic importance.

The following, amongst others, are either new to Science or first records for Serbia: *Podosphaera tridactyla*, on leaves of *Prunus Armeniaca*; *Leptosphaeria Tritici* on the leaves of wheat; *Uromyces Tropaeoli* sp. nov. on the living leaves of *Tropaeolum majus*; *Phyllosticta Betae* on the leaves of *Beta vulgaris*; *Cicinobolus Humuli*, parasitic on *Erysiphe Polygoni*; *E. Cichoriacearum* and *Sphaerotheca Humuli* (T); *Septoria Nuphar* sp. nov. on the living leaves of *Nuphar luteum*; *Dilophospora graminis* on the ears and leaves of wheat; *Oidium Tuckeri* on grapes; *O. quercinum* on the leaves of *Quercus pubescens* and *Q. sessiliflora*; *Microbasidium Sorgi* (species representing the new genus *Microbasidium*, instituted by Bubák and Ranojevic, and synonymous with *Fusicladium Sorgii* Pass.), on the living leaves of *Sorghum saccharatum*.

- 1185 - *Pellicularia Koleroga* injurious to Coffee in Porto-Rico (2). FAWCETT, G. L., in *Journal of Agricultural Research*, Vol. II, No. 3, pp. 231-233, figs. 1-3. Washington, D. C., 1914.

In 1912 J. Kuijper reported that comparisons of the fungus causing the disease known as "zilverdraadziekte" of coffee in Surinam with

(1) See in this connection, No. 75, B. Jan. 1914.

(2) See No. 2983, B. Aug.-Sept.-Oct. 1911.

the fungus causing the so-called leaf-blight of coffee in Porto Rico led to the conclusion that the latter disease is not identical with the descriptions of *Blizzaria Koleroga* Cooke in India, and observed also that it differed from the fungus causing the "candelillo" disease in Venezuela.

However, considering the mistakes in the original descriptions of fungi causing other coffee diseases, and on the other hand the fact that the descriptions correspond sufficiently with the characters of the fungus found in Porto Rico, it seems justifiable to identify this fungus with *P. Koleroga*. Further, the specimens of *P. Koleroga* collected in Mysore, where Cooke first described the disease, agree perfectly with those found in Porto Rico. It is therefore erroneous to consider the Porto Rico disease as different from that of *P. Koleroga* Cooke.

The researches on the Venezuela disease ("candelillo") support the conclusion of Kuijper that the fungus is distinct from *P. Koleroga*, though related to it.

It is therefore concluded that *P. Koleroga* exists in the Antilles and the North American continent as well as in India, and that a fungus of similar appearance and causing a disease known as "candelillo" has also been found on the continent. This appears to be the only fungus of this nature found in Venezuela and was wrongly identified as *P. Koleroga* Cooke.

86 - A Contribution to the Morphology and Life History of *Pestalozzia funerea* Desm. — WENNER, J. J., in *Phytopathology*, Vol. 4, No. 5, pp. 375-384, plate XXVII, figs. 1-7. Baltimore, Md., 1914.

The question of the exact relation of *Pestalozzia funerea* Desm. to the various coniferous hosts on which it has often been recorded in both Europe and America, has for many years been more or less in doubt. Other species of *Pestalozzia* have often been reported as appearing in close relation with diseased plants, yet actual proof of their parasitism is lacking in many cases.

In plate culture, in addition to the typical 4-septate conidia, another kind of spore appeared, resembling a chlamydospore; on germination, is produced a mycelium, the hyphae of which under favourable conditions produced similar chlamydospores, or, on plate and tube cultures, the typical 5-celled conidia.

Inoculation experiments proved conclusively that this species is parasitic under certain conditions, the most important of which appears to be the presence of a great amount of moisture in the air. The fungus is capable of attacking both the leaves and stems of the hosts used in the experiment, viz. Weymouth Pine (*Pinus Strobus* L.), Norway spruce (*Piceaabies* [L.] Karst.), and hemlock (*Tsuga canadensis*). The symptoms of the disease are browning of the leaves, followed in some cases by the appearance of superficial mycelium, the drooping of the young shoots, and the development of the acervuli. The shoots finally die and eventually the whole tree is killed.

As means of control, diseased seedlings should be destroyed as soon as detected, and as a preventive, the ordinary methods of spraying with Bordeaux mixture will probably be effectual.

1187. - *Puccinia Menthae* on *Mentha canadensis* var. *piperascens* in Hungary (1). — GRÖF, BÉL., in *Kisérletiügyi Közlemények*, Vol. XVII, Part. 4, pp. 657-661, 2 figs. Budapest, 1914.

Puccinia Menthae Pers. attacks not only *Mentha arvensis*, *M. crispata* and *M. piperita*, but also *M. canadensis* var. *piperascens*, which has been grown in Hungary for some years.

On this host the aecidium stage develops towards the end of April on the stems of shoots 4 to 6 in. long. It causes a swelling between the first and second node, which results in a curvature of the stem; in some cases the swelling extends over the whole surface of the stem, resulting in twisting. The diseased plants retain green leaves only at the summit, the rest being shrivelled.

Uredospores appear in July and teleutospores at the end of September.

The disease causes a very poor yield owing to the damage to the leaves and the reduced quality of the essence.

✓ Treatment consists in collecting and burning the fallen leaves in autumn and spraying the infected plots with a 2 per cent solution of copper sulphate. The spraying should be repeated in the spring and the crop cut during June before the appearance of the uredospores.

- 1188 - American Gooseberry Mildew in Italy (2). — GREPPI, CARLO, in *Rivista di Patologia vegetale*, Year VII, No. 4, pp. 97-99. Pavia, 1914.

The occurrence of American gooseberry mildew (*Sphaerotheca mors-urae* [Shwein.] Berk. et Curt.) was recorded on the shoots, leaves and fruits of gooseberries in the middle of May 1914, in a garden at Tromello (prov. of Pavia).

Gooseberries are very little grown in Italy, so that this fungus cannot be of such importance as in other European countries.

- 1189 - *Hypochnus Burnati*, a New Fungus on the Vine in Switzerland. — LENDNER, A., in *Bulletin de la Société botanique de Genève*, 2nd Series, Vol. VI, No. pp. 104-106, 1 fig. Geneva, 1914.

Towards the end of autumn in 1913, several vines growing near to each other in a vineyard at Bossey appeared to be diseased, and peculiar nodular excrescences known to French growers as "broussins" were observed on the stems.

Surrounding these tumours was a white felted growth resembling its characters the fungus *Aureobasidium Vitis* Viola and Boyer, but actually belonging to a new species of *Hypochnus*, described by the writer as *H. Burnati*.

Analysis of the soil showed a high percentage of lime, which the writer considers is the primary cause of the disease. This new *Hypochnus* is considered to be a secondary parasite, or perhaps a saprophyte.

(1) See also No. 1211, B. Oct. 1913.

(2) See also No. 183, B. Feb. 1914; No. 953, B. Oct. 1914; and No. 1068, B. Nov. 1914.

(Ed.)

PARASITIC AND OTHER INJURIOUS FLOWERING PLANTS.

c - **Parasitic Flowering Plants on Para Rubber Trees in Negri Sembilan (F. M. S.).**—BROOKS, F. T., in *The Agricultural Bulletin of the Federated Malay States*, Vol. II, No. 7, 1p. 165-166. Kuala Lumpur, February 1914.

A considerable number of trees in *Hevea* plantations were noticed to be attacked by two kinds of parasitic flowering plants, not yet determined (1), in a manner similar to that in which mistletoe attacks certain trees in Europe. The parasites possess green leaves, but weaken the host by obtaining supplies of water and mineral salts from the branches, to which they are attached by means of suckers. Several of the rubber trees carried one or more of these parasitic growths, which were evidently doing considerable damage, the portions of the branches beyond the place of attachment of the parasite being killed in a number of cases.

Their simple entire leaves and prominent position on the branches make the presence of these parasites easy to detect.

The area which was most affected by these parasitic plants consisted almost entirely of trees in poor condition. The foliage was thin and it is probably this circumstance which enabled these parasites to become established, for in a tree possessing a healthy and vigorous leaf canopy the light below the crown would probably be sufficiently reduced to prevent the development of these troublesome plants.

All branches bearing such growths should be cut out, and efforts should be made by manuring to stimulate a more vigorous development of the trees, which should be rested until a better leaf canopy has been developed.

ii - **Experiments on the Food Requirements and Growth of Couch (*Agropyron repens*).** BURMESTER, HERMANN (Breslau), in *Fühlings Landwirtschaftliche Zeitung*, Year 63, Part 16, pp. 547-556, 1 fig. Stuttgart, August 15, 1914.

The writer has made a number of experiments with couch-grass (*Agropyron repens*), in completion of those published by Kraus as No. 220 of *Arbeiten der D. L. G.* (1).

In pot experiments with a light loam soil it was found that pieces of rhizome placed at a depth of 30 cm. (12 in.) did not succeed in reaching the surface, while at 15 cm. (6 in.) the growth made in more than three months was not much less than with pieces at a depth of only 4 cm. (1 ½ in.).

Manurial experiments showed that couch can grow well in very poor soil; when given abundant supplies of nutritive substances it makes a somewhat increased growth, but the increase is by no means proportional to the absorption of these substances, the result being that the plant becomes abnormally rich in the particular nutrients supplied.

In a series of pot experiments in which oats were sown with and without rhizomes of couch, it was found that the yield of grain of the oats was

(1) Probably *Loranthus* spp., which are common parasites on *Hevea*, *Citrus*, and other trees in Malaya. (Ed.)

(2) See No. 1472, B. Oct. 1912. (Ed.)

always distinctly greater when couch was present, while the yield of straw was only slightly reduced; comparison with similar series in which couch was grown alone showed that the oats had greatly hindered the growth of the couch, reducing it to from 5 to 15 per cent. of the normal.

INSECT PESTS.

1192. — **New Coccidae in Japan.** — KUWANA, S. I., in *Journal of Entomology and Zoology*, Vol. VI, No. 1, pp. 1-8, plates I-III. Claremont, Cal., 1914.

A systematic description of the following eight new species of Coccidae recently recorded:

1) *Xyllococcus napiiformis*, on *Quercus serrata*, at Nishigahara, Toki and other localities in Japan.

2) *Phenacoccus azaleae*, on the branches and underside of the leaves of *Azalea*; closely allied to *P. pergandei* Ckll.

3) *Eriococcus festucae*, on *Festuca parvigluma*, at Nishigahara, Tok (1910); closely allied to *E. insignis* Newst. and *E. greeni* Newst.

4) *Pulvinaria citricola*, on *Citrus*, at Okayama, Shizuoka, and *Diospyros Kaki*, *Hibiscus syriacus*, *Citrus* and other plants at Toki; closely allied to *P. cellulosa* Green; has one generation per year and is very injurious to *Citrus* at Shizuoka and Okayama.

5) *P. photiniae*, on *Photima illosa* and *Celtis sinensis*, at Nishigahara Tokio (1912).

6) *P. okitsuensis*, on oranges, at Okitsu, Shizuoka-ken (1912); allied to *P. thespesiae* Green.

7) *P. idesiae* on *Idesia polycarpa* and *Phellodendron amurense*, Nishigahara, Tokio (1911); near *P. horii* Kuw.

8) *Lecanium (Eulecanium) pseudomagnoliarum*, on *Citrus*, at Toki and Shizuoka (1911); allied to *Lecanium (Eulecanium) magnoliarum* Ckll. recorded as occurring on *Berberis nepalensis* at Tokio and on the vine at Shizuoka-ken (1912); this is the first record of this species in Japan.

1193. — **New Species of Hymenopterous Parasites on *Heliothis armigera* at *Caradrina exigua* in Russian Turkestan.** — KOKUJEV, NIKI A., in *Revue russe d'Entomologie*, 1913, Vol. XIII, No. 3-4, pp. 513-514. Petrograd, 1914.

A systematic description of the following new Hymenoptera: *H. bracon simonovi*, reared from a larva of *Heliothis armigera* H. (= *H. obsoleta* F.) (1); *Chelonus caradrinae* and *Microplitis ruficornis* obtained from a larva of *Caradrina exigua* Hb. (= *Laphygma flavicincta* Harr.).

(1) See also No. 2384, *B.* Aug.-Sept.-Oct. 1911; Nos. 125 and 194, *B.* Feb. 1912; No. 203, *B.* March 1913; No. 627, *B.* June 1913; No. 1117, *B.* Sept. 1913. (Ed.)

4. - *Dichomeris ianthes*, *Catopsilia crocale* and *Catachrysops pandava*, injurious to Lucerne, Cassias and Cycas in Ceylon. — RUTHERFORD, A., in *The Tropical Agriculturist*, Vol. XLIII, No. 3, pp. 222-224. Colombo, 1914.

In December 1913, the lucerne at the Experiment Station, Peradeniya, badly attacked by the caterpillar of the Tineid moth, *Dichomeris ianthes* Meyr., which folds the leaflets from below upwards and eats them patches. A few of the caterpillars had been parasitised by a small ichneumonid.

In April 1914, several of the Cassias in the Botanic Gardens were defoliated by the caterpillars of the butterfly *Catopsilia crocale* Cramer. The caterpillars have the habit during the heat of the day of climbing leaflessly up and down the trunk and congregating between the limbs at the base of the tree. Advantage was taken of this to feed them with branches of Cassia sprayed with arsenate of lead. These cut branches, however, soon withered in the strong sunlight. A few Chalcids were noticed about the pupae. Several of the caterpillars contained Dipterous puparia. A small number were also attacked by a disease which prevented them from pupating.

The surrounding bushes and trees were covered with pupae. On the underside of one leaf of *Bryophyllum* sp. fifteen were suspended and another fourteen. Hundreds were found on the neighbouring *Palmyras*, chiefly on the under-surface of the uncut leaf-bases.

Among the pupae crows and king-crows did good work, though the latter did some damage by breaking off leaves and twigs from the more tender plants. The king-crow was also observed feeding greedily on the caterpillars. A branch of parasitic *Loranthus* growing on one of the Cassias was untouched.

In March 1913, the larvae of *Catachrysops pandava* Horsf. attacked the fronds of *Cycas revoluta* in the Botanic Gardens and stripped them almost to the midrib. There were holes in the midrib at intervals, and the tissue was eaten out and the cavity full of a blackish or brownish evil smelling frass.

Larvae and pupae were present, often several in the interior of each frond. In January 1914, these same caterpillars were feeding on the underside of the fronds, eating through to the upper epidermis. They were attended by ants, *Camponotus* sp.

In May of the same year, the young fronds of *Cycas Rumphii* were attacked; they elongated but were reduced to the midrib, which was dead, withered and bent and hung limp at the apex, giving the tree a very unhealthy appearance. In this case also holes had been eaten into the midrib, but there was no extensive mining in the interior, probably because there is sufficient food externally to enable them to complete their growth. The butterflies were actually observed ovipositing on the tender fronds. Many of the eggs were ruptured and a minute, brownish ant was observed actively nibbling at the eggs. An application of arsenate of lead when the caterpillars are young is recommended for this pest.

1195 - **Animal Pests of Camphor in Ceylon.** — RUTHERFORD, A., in *The Trop. Agriculturist*, Vol. XLII, No. 6, pp. 463-468. Colombo, 1914.

The writer describes the following insect pests of camphor (*Cinnomum Camphora*) in Ceylon:

1) Thrips (probably *Cryptothrips floridensis* Watson, recently described as injurious to camphor in Florida), not previously recorded in Ceylon. It damages the buds, leaves and branches, causing them to blacken and die. Spraying with tobacco decoction is recommended.

2) Leaf-miner of camphor (*Acrocercops* sp.); the larva mines in the upper epidermis of the young leaves, causing a large blotch; the gall seems to start from any point, but in most cases the narrowest part is presumably the earliest part of the gallery occurs towards the base of the leaf and often on the petiole. The larva is parasitised by a Chalcidid and a Braconid very effectively. Spraying the diseased leaves with tobacco decoction is recommended.

3) The large bagworm (*Clania variegata* Snell.); the case in which the grub lives is made of brownish-white silk surrounded by pieces of sticks and twigs lying in a horizontal direction. Probably the best way to deal with this pest is to collect and destroy the caterpillars.

4) Bagworm (probably *Amatissa consorta* Templ.); the case is composed of short pieces of twig arranged in a spiral.

5) Larvae of two species of Pyralid (?), one of which is injurious to the buds and the other to the young leaves.

The following insects are also mentioned:

1) *Xyleborus compactus* Eichh., occurring also on tea, coffee, and avocado pear; 2) *X. argutus* Wynne Sampson, which according to Green bores living branches; 3) *Hylopertha* sp., recorded by Green on dead or diseased wood; 4) *Lepidiotia pinguis*, recorded by Green as feeding on the roots; 5) *Stenoncolor*, *Papilio lankeswara*, *P. clytia*, *Attacus atlas*, whose caterpillars recorded by Green as feeding on the leaves; 6) twig girdler, a Lepidopterous larva which mines in the young twigs, often causing them to wither and fall over; it bears a marked resemblance to the one found feeding on the buds and referred to above, and it is possible they are one and the same species; 7) *Coptosoma siamicum*, observed feeding on the young shoots; 8) *Aspidiotus* (probably *A. camelliae*) observed on the buds and twigs; 9) *Tetranychus bioculatus*, recorded by Green as occurring in injurious numbers on the upper surface of the leaves; 10) *Brevipalpus obovatus*, recorded by Green; 11) mice, recorded by Green as digging up and devouring the plants in the nursery.

1196 - **Outbreak of *Malacosoma fragilis* in California.** — VAN DYKE, EDWARD (Dept. of Entomology, University of California, Berkeley, Cal.), in *The Monthly Bulletin of State Commission of Horticulture*, Vol. III, No. 9, pp. 351-354, figs. 1-6. Sacramento, Cal., September 1914.

The genus *Malacosoma* (*Lasiocampidae*) contains several species known to be injurious to various trees, including apples, in California: they are *M. californica* Pack. (on live oaks and apple), *M. constricta* Stretch,

and white oaks), *M. pinivalis* Dyer (on alder and apple) and *M. illis* Stretch.

The larvae of the last-named, known as the Great Basin tent caterpillar, were found to be present in enormous numbers during the past summer species of *Ceanothus* forming brush in the country about Mt. Shasta. It appeared early in June; by the beginning of July, having defoliated *Ceanothus* bushes, they migrated in vast hosts, attacking the leaves of trees (except Conifers) they came across; a few reached some apple trees, where they showed themselves as destructive as the other species mentioned above. They also became a great nuisance on the railways, owing to their crushed bodies causing slipping; eventually the engines were fitted with steam jets to blow them off the rails.

Many of the caterpillars were parasitized by various species of Tachinid flies, which, however, made little impression on the numbers; others were parasitized by ichneumon flies, while two species of *Calosoma* and two species were preying on them.

— *Phloeotribus scarabaeoides* and *Hylesinus oleiperda*, Beetles injurious to Olives in the Arezzo District, Italy (1). — DE ROSA, ANTONIO, in *Il Collettore*, Year 60, No. 28, pp. 301-305, figs. 47-49. Casale Monferrato, 1914.

Phloeotribus scarabaeoides Bern. (*P. oleae* F.) and *Hylesinus oleiperda* (fam. *Ipididae*), bore galleries in olive branches, and are the cause of considerable damage in the country round Arezzo, especially on the hills lying east near Staggiano.

For the control of these insects the writer recommends: a) destruction of the insects during the winter by cutting and burning the diseased branches; b) rational pruning of the trees; c) careful cultivation of the soil; complete manuring for the trees.

4. — *Tetropium gabrieli* var. *crawshayi* on Larch in England. — OSMASTON, B. B., in *Quarterly Journal of Forestry*, Vol. VIII, No. 1, pp. 277-279, figs. London, 1914.

Tetropium gabrieli var. *crawshayi* has recently been reported on larches several widely separated localities in England, viz. Maer (North Staffordshire), Gerard's Cross (Berkshire) and Hayward's Heath (Sussex).

The insect deposits its eggs in the crevices of the bark of unhealthy trees. The larvae devour the phloem and cambium and even penetrate into the wood before pupating. The tree succumbs quickly and the external layers of the wood, especially the sapwood, show slight damage. Healthy trees do not appear to be attacked. This beetle finds conditions in England favourable to its development, since most larch plantations contain trees attacked by canker (*Dasyscypha calycina* Fuckl.) and by "hermes" (*Chermes laricis* Hartig), and it will not be surprising if it assumes considerable importance in the future.

(1) See also No. 3064, *B.* Aug.-Sept.-Oct. 1911; *B.* Oct. 1913, p. 1561; No. 1312, Nov. 1913. (Ed.).

Plantations should as far as possible be cleared of all unhealthy diseased trees. As soon as a tree is attacked by the insect, as indicated by the wilting of the leaves in summer and confirmed by the presence of larvae under the bark, it should be cut down and made into timber, stripped of its bark and the chippings burnt. If the green woodpecker (*Geococcyx viridis* L.) is present, the diseased trees may be recognised by the holes in the bark. Dead larches are sometimes found with holes from which the woodpeckers have extracted the grubs, so that only a small number survive to propagate the species.

The following rules are recommended for new plantations: a) the plantations should be limited to districts where the larch is known to thrive; b) mixed plantations should be made, so as to maintain more natural conditions; c) the trees should not be too dense at the time of thinning out as poles.

